

Alimentary system

1. Oral cavity

Lips muscles: orbicularis oris, sup.&inf. Labial muscles, buccinator muscle

Masticatory muscles: masseter, medial & lateral pterygoids, temporal

Superior and inferior labii muscles are covered externally by skin and internally by mucous membrane.

The mucous membrane covers the intraoral vestibular part of lips – pars mucosae.

Cheeks have the same structure as the lips – they are the visible walls of the oral cavity.

Oral cavity: (a) oral vestibule b/w teeth and buccal gingival – controlled by sphincters, orbicularis oris, buccinator, levator & depressor of lips. Isthmus of buccopharynx opens into middle part of pharynx

Borders:

roof: palate

floor: tongue and the mucosa (supported by geniohyoid and mylohyoid muscles)

lateral&ant.: lips & cheeks.

Post: oropharynx, inner body wall (teeth and gums)

(b) Oral cavity proper: area inside teeth and gingiva b/w upper & lower dental arch.

Submandibular and sublingual ducts open.

Oral vestibule: between lips and cheeks (teeth and buccal gingival) – opening of parotid duct in upper 2nd molar tooth. Oral opening controlled by the sphincters, orbicularis oris, buccinator, levator and depressor of lips.

2. Teeth

The teeth have different surfaces: (A) inner – palatine (only for upper teeth), lingual (for both upper and lower). (B) opposite surface: facing toward the lips or toward the cheeks (buccal surface – molar or premolar teeth). (C) masticatory – for molar and premolar only.

Structure of teeth: enamel: covers the crown, the hardest substance.

Dentin: hard substance lining central pulp space

Pulp: fills the central cavity which continues the root canal. Contains blood vessels, nerves, lymphatics (enter the pulp through apical foramen at the apex of the root).

Parts of teeth: crown (project above the gingival surface and it is covered by enamel), neck (constricted area at the junction of the crown and root), root (covered with connection which connected the bone of alveolus by periodontal ligaments)

Maxillary molar → 3 roots

Mandibular molar → 2 roots

32 teeth: incisors (single root cutting and biting), canines (single root and tearing), premolar (2 cusps, single root, grinding), molar (3 cusps, upper molar has 3 roots and lower has 2 roots).

Arteries: branches of maxilla, post maxilla & gingiva by ant/sup alveolar a. And ant maxilla & gingiva by inferior alveolar a. Mandible: inf alveolar a. dental & pre-dental branches.

Nerves: maxillary and mandibular branch of trigeminal N.

Veins: flow into pterygoid plexus.

Lymphs: submental, submandibular, deep cervical lymph nodes.

3. Tongue:

Mobile muscular organ. Partly in the oral cavity and in oropharynx. Involved in mastication, taste, swallowing & oral cleaning. V shaped. Fnx: speaking, squeeze food to oropharynx.

Surfaces: root: (rest on the floor of the mouth, posterior). Body: (anterior). Apex: (anterior end of the body rest against the incisor). Dorsum: (dorsal surface, posterior and superior surface, located at the oral cavity & oropharynx)

Lingual papilla: vallate papillae, foliate, filiform, fungiform

Muscles: extrinsic(move tongue): genioglossus, hypoglossus, styloglossus, palatoglossus m. Intrinsic: superior& inf. Longitudinal, transverse, vertical (not attach to one).

Blood supply: great&lesser palatine a., ascending palatine a.

Innervations: lingual nerve, chorda tympani, glossopharyngeal n., internal laryngeal n.

Tastes: sweet (apex), salty (lat margin), sour and bitter (post part).

4. Palatine, lingual, pharyngeal and tubal tonsils.

Palatine tonsils: rounded masses of lymphatic tissue. Located on each side of pharynx and in tonsillar fossa. Bounded by palatoglossal arches, palatopharyngeal arches, tongue. Has non keratinized stratified squamous epithelium.

Lingual tonsils: rounded masse of lymphatic tissue. Cover base of tongue – posterior region. Has dense & nodular lymph tissue. The surface is covered by Stratified squamous epith. Partially surrounded by connective tissue.

Pharyngeal (adenoids): a mass of lymphoid tissue. Situated at the very back of the nose in the roof of nasopharynx. Has pseudostratified columnar ciliated epithel. Lack of crypts, sometimes they are taken out.

Tubal: posterior to the opening of pharyngotympanic tube into the nasopharynx. Has Ciliated pseudostratified columnar. Protect from respiratory infections. Smal oral mass of lymphoid tissue. Help and protect the body from respiratory infections.

Pharyngeal lymphoid ring: located on pharynx& at back of oral cavity consist of above tonsils.

5. Salivary glands

Exocrine glands, tasteless, excrete odorless fluid: saliva, begin digest starch. Prevent teeth decay, secreted by parotid, submandibular, sublingual & mucous glands. Serve as mouthwash. Lubricates the food during mastication.

Parotid glands: pure serous gland, largest salivary gland, has parotid duct→ stensen's.

Innervations: parasympathetic fibers of glossopharyngel n. Blood supp: internal carotid a. & branches.

Secret watery saliva by parasympathetic stimulation. Produce small amount of viscous saliva by sympathetic stimulation.

Submandibular gland: lies along body of mandible, in submandibular triangle. Superficial portion is situates superficial to mylohyoid m. Its deep portion is b/w lingual n& hypoglossal n. Wharton's duct. → arises from the deep portion and runs forward between mylohyoid hypoglossus muscle.

Innervations: Fascial nerve. Blood supply: Submental a.

Sublingual gland: located in the floor of mouth b/w mucous membrane above & mylohyoid muscle below. Surrounds the terminal portion of submandibular duct. Empty to floor of mouth. Supply by Lingual & facial nerve. Blood supply: Submental a.& sublingual a..

6. Pharynx

Fibromuscular tube. 12-15cm long. Superior part of alimentary system. From base of skull to the inferior border of cricoid cartilage. Conducts Food to esophagous & air to larynx-lungs. Anteriorly communicates with nasal cavity& oral cavity and larynx. Divided into: nasopharynx, oropharynx, laryngopharynx.

Nasopharynx: behind the nasal cavity, above the soft palate, communicates with nasal cavity through the nasal choanae. Contains pharyngeal tonsils posteriorly. Connected with tympanic cavity through the auditory tube.

Oropharynx: extends between the soft palate, above and superior border of epiglottis.

Laryngopharynx: opens into the larynx and laryngeal inlet.

Innervated by pharyngeal branches of glossopharyngeal, vagus n. and sympathetic branch of cervical ganglion. Blood supply: ascending pharyngeal a. palatine branch of facial a. pharyngeal branch of maxillary a. sup. & inf. Thyroid art, descending palatine artery.

Veins: pharyngeal and external palatine veins.

Muscles: Circular muscles → superior, middle, inferior constrictors. Longitudinal → stylopharyngeus, palatopharyngeus, salpingopharyngeus.

7. Esophagus

Muscular tube, 25cm long. Continues with pharynx in neck & enters the thorax behind trachea. Extent from pharynx to stomach. 3 parts : cervical-rest on vertebral column & trachea. Thoracic-parallel to trachea. Abdominal –short, extends from oesophageal hiatus of diaphragm, connected with stomach.

Relations. Anterior: trachea, left recurrent laryngeal n., left main bronchus, pericardium

Posterior: bodies of t-vertebrates, thoracic duct, azygos vein, descending thoracic aorta

Right: mediastinal pleura, terminal part of azygos vein

Left: left subclavian a., aortic arch, thoracic duct, mediastinal pleura.

Innervations: esophageal plexus, vagal trunk, vagus n., greater splanchnic n.

Blood supply: celiac trunk → gastric a. esophageal branch of: thoracic a. & thyroid a.

Veins: submucosal venous plexus, portal venous system, azygos v, systemic venous system.

Muscles: inner circular m, outer longitudinal m.

8. Stomach

The most elastic organ of body.

J shaped, intraperitoneal. Parts: fundus, body, pylorus, greater omentum, lesser omentum.

Stomach wall: outer is smooth (visceral peritoneum), inner : mucosa with gastric folds

On lesser omentum: right and left gastric arteries. On greater omentum: R&L gastroepiploic a.

Fundus: short gastric a.

Blood supply: arteries usually from branch of celiac trunk.

Nerves: parasympathetic: greater splanchnic n. sympathetic: vagus n.

Join with oesophagus in gastroesophageal opening and with duodenum in pylorus part and pyloric sphincter.

9. Duodenum

Divided into four segments: superior, descending, horizontal and ascending parts. It's part of small intestine.

C shape. Around pancreas. Retroperitoneal. Joint with pylorus of stomach, attached to liver by hepatoduodenal lig. Descending part: b/w sup & inf. Duodenal flexures. Inferiorly horizontal is between head of pancreas. Ascending part: joints to duodenojejunal flexure.

Blood supply: sup inf pancreaticoduodenal a., gastroduodenal a. common hepatic a.

Lymph: pyloric, pancreaticoduodenal nodes, hepatic, celiac nodes.

10. Jejunum & ileum.

Intraperitoneal. Connected by mesentery on abdominal back which allows movement. 6-7 cm. Lie in lower quadrant of abdominal pelvis. In right iliac fossa → empties in large intestine to ileocecal junction.

Jejunum: less arterial arcades than ileum, has long circular folds. Has longer vasa recta.

Blood supply: branches of sup mesenteric a. & iliac jejunal a.

Lymph: mesenteric & ileocolic lymph nodes.

Nerves: vagus & splanchnic nerves.

11. Large intestine:

Contains: cecum, appendix, colon, rectum. About 1,5 m.

Cecum & appendix: cecum is covered by peritoneum. 6-10 cm appendix containing lymphoid tissue (teniae). Cecum connects the small with large intestine.

Ascending colon: from cecum to right liver lobe. Blood: right colic, ileocolic, middle colic. Retroperitoneal.

Transverse colon. Intraperitoneal. Attached to post wall by transverse mesocolon, to liver by hepatocolic lig., to stomach by gastocolic lig. Blood: middle, left, right colic a.

Descending colon: retroperitoneal. Fixed by phrenicocolic lig. Continues to sigmoid colon.

Sigmoid colon: s shape. Retrosigmoidal junction. Blood: left colic a, sigmoid a. Nerve: sympathetic: sup mesentery plexus., parasympathetic: inferior hypogastric plexus.

12. Rectum

Last part of large intestine. It's where the stool (faeces) is stored before being passed as a bowel motion.

Slightly s shape. Sacral & anorectal flexures. In males: prostate & seminal vesicles. In females: vagina.

Cavity of Douglas. Arteries: sup, middle, inf rectal. Veins: Sup & inf rectal. Nerves: inf hypogastric plexus.

Muscles: anus sphincter, externus, levator ani m.

13. Pancreas

Retroperitoneal. 12-15 cm long.

Parts: head, neck, body, tail.

Head: lies in duodenal loop. Body: in front of L1. Tail: higher if T12, in splenorenal lig.

Pancreatic duct on post surface: empties in duodenal papilla.

Blood: sup pancreaticoduodenal a(head), splenic a(body & tail) .

14. Liver

Intraperitoneal, reddish brown organ. Covered by visceral peritoneum. Falciform lig- attached. To parietal peritoneum of anterior abdominal wall. Hepatoduodenal lig : to duodenum. Hepatogastric lig: lesser curvature of stomach.

Diaphragmatic surface(ant. Part): divided by falciform lig. To right lobe and left lobe. By coronary lig. To right triangular lig and left triangular lig.

Visceral surface: close to adjacent organs. Porta hepatis. Hepatic artery proper, right & left hepatic duct.

Fissure for round lig. , fissure for ligament venosum.

Fossa of gallbladder & caudal lobe. Papillary process. Arteries: hepatic a. proper. Nerves: celiac ganglion & vagus n.

Lobes of visceral: are divided by ligamentum venosum and ligamentum teres. The porta hepatis divides the caudate from the right: renal impression, colic impression, duodenal impression, left: gastric impression.

15. Biliary ducts and gallbladder

Is a small organ that aids mainly in fat digestion and concentrates bile produced by the liver.

In humans the loss of the gallbladder is usually easily tolerated.

A bile duct is any of a number of long tube-like structures that carry bile.

Bile, required for the digestion of food, is excreted by the liver into passages that carry bile toward the hepatic duct, which joins with the cystic duct (carrying bile to and from the gallbladder) to form the common bile duct, which opens into the intestine.

Pear shape. 8-12 cm long.

Parts: fundus, body, neck.

Supplied by the cystic artery.

Fundus: contracts transverse colon. Body: rest on transverse colon & duodenum. Neck: directed towards porta hepatis.

Nerves: coeliac and phrenic nerves.

Lymph: porta hepatis lymph.

16. Peritoneum

Serous membrane lined by mesothelial cells. Consists of parietal & visceral peritoneum.

(a) Parietal: lines abdominal & pelvic walls & inferior surface of diaphragm. Innervated by somatic nerves phrenic, iliohypogastric, subcostal, ilioinguinal nerves.

(b) Visceral: covers viscera & innervated by visceral nerve.

Has Omentum: fold of peritoneum extending from the stomach to adjacent organs.

Lesser omentum: double layer from porta hepatis of liver to lesser curvature of the stomach & the beginning of duodenum. Consist of hepatogastric & hepatoduodenal lig.

Greater omentum: from greater curvature of stomach covering transverse colon and abdominal viscera. Consists of 4 ligaments: gastrosplenic, lienorenal, gastroepiploic, gastrocolic.

Mesenteries: small intestine, transverse & sigmoid mesocolon & mesoappendix.

Peritoneal Ligaments: phrenicocolic ligament, falciform lig, round lig, right and left coronary lig, right and left triangular lig, gastrosplenic/gastrophrenic/phrenicosplenic lig

Peritoneal folds: umbilical, ileocecal, rectouterine

Peritoneal cavity: divided into greater sac and lesser sac.. lesser sac behind liver, lesser omentum and stomach.. greater sac from diaphragm to pelvic floor

17. External nose. Nasal cavity

Part of respiratory tract. Nose include: external nose & nasal cavity separated by nasal septum.

Function of nasal cavity: conduction, warming, filtering air, olfaction

Anatomy of nose: 2 nasal bones, piriform aperture, lateral nasal wall, ala, nostrils, apex

Hyaline cartilage on each side by major alar cart.

Blood supply: angular, facial, ophthalmic, post nasal, infraorbital a., facial vein, superior ophthalmic vein

Innervations: nasal mucosa, maxillary nerve, nasopalatine nerve, post superior lateral nasal nerve, posterior inf lateral nasal n, ophthalmic nerve.. infratrochlear nerve, olfactory nerve..

Roof: formed by nasal, frontal, ethmoid & sphenoid. floor: formed by palatine process of maxilla, palatine bone. Medial wall(septum) formed by perpendicular plate of ethmoid, vomer, cartilage. Lateral wall: formed ethmoid, sup, middle, inf nasal concha.

18. Paranasal sinuses

Involved in reduction of weight & resonance for voice

Consist of the ethmoidal, frontal, maxillary and sphenoidal sinuses.

Ethmoidal sinus: consist of ethmoidal air cell . Post, middle, anterior ethmoidal air cells
Frontal sinus: lies in frontal bone, opens in hiatus semilunaris, lies in maxilla
Sphenoidal sinus: in the body of sphenoid bone. Opens into sphenoidal recess. Above is pituitary gland, branches of maxillary nerve and posterior ethmoidal branch of nasolacrimal nerve
Maxillary sinus: largest, present at birth, lies in maxilla on each side lateral to the lateral wall of nasal cavity and inferior to the floor of orbit

19. Larynx

At level of c3-c6. 9 cartilages. Connects pharynx to trachea.

Thyroid- hyaline cartilage: right & left lamina, laryngeal prominence, oblique line, sup thyroid notch, sup & inf horns, cricoid articular surface.

Cricoid hyaline: on post is lamina of cricoid cartilage. Arch of cricoid, thyroid articular facet, arytenoid art. Facet.

Arytenoid: 3 surface: anterolateral, medial, posterior. 3 borders: apex, base, 2 processes.

Epiglottic: elastic cartilage. ant surface: pharynx side. Post surface: larynx side.

Also: 2 corniculate, 2 cuneiform

Ligaments: thyrohyoid, median & lat thyroid lig, median cricothyroid, cricotracheal, thyroepiglottic, hyoepiglottic.

Joints: cricothyroid, cricoarytenoid

Muscles: extrinsic: cricothyroid -> sup laryngeal n.

Intrinsic: cricoarytenoid post, cricoarytenoid lateralis, transverse arytenoid, thyroarytenoid, arytenoids, ablique. Vocalis → Recurrent laryngeal nerve.

Arteries: laryngeal, sup laryngeal, cricothyroid, inf laryngeal a.

Veins: sup & inf laryngeal v.

Nerves: sup. & inf laryngeal nerves from vagus nerve.

20. Trachea, bronchi.

Trachea extends from cricoid cartilage c6 -> t4. Horseshoe hyaline cartilages linked by annular ligaments.

Tracheal bifurcation: right and left main bronchi. Right bronchus is shorter and wider than the left.

Supplied by inferior thyroid a & bronchi by its bronchial branches. Trachealis m : recurrent laryngeal nerve.

Bronchopulmonary segments: subunits of lung lobules, organized by segmental bronchi & accompanied by a branch of pulmonary artery.

21. Lungs

Attached to heart & trachea by their roots and pulmo. Innervate smooth m & glands of bronchial tree.

Receive parasympathetic fibers. Have sensory endings of vagal origin. Have base, rest on convex surface of diaphragm, descend during inspiration & ascend during expiration.

Right lung: Right lung has superior middle inferior lobe, superior and inferior are divided by the oblique fissure, superior and middle are divided by the horizontal fissure. Has an apex. Its heavier because heart is on the left. has 3 lobar bronchi and 10 segmental. Has grooves for subclavian artery, grooves for arch of azygos vein and esophagus.

Left lung: consist of superior and inferior lobe. Divided by cardiac fissure. Has 2 lobar bronchi and 8 or 10 segmental. Has cardiac impression, cardiac notch and grooves for arch of aorta, subclavian and thoracic descending aorta. Left is smaller than right one...

Innervations: pulmonary plexus, phrenic nerve,

22. Pleura

Thin serous membrane: has squamous epithelium. Parietal & visceral.

Parietal: lie in inner surface of thoracic wall & mediastinum. 4 parts: costal, mediastinal, diaphragmatic, cervical.

Innervated by intercostal & phrenic n. branches of internal thoracic, sup phrenic, post & sup intercostal arteries.

Visceral: invests the lungs & dips in all fissures. Bronchial a, venous blood from pulmo v. contains vasomotor fibers.

Pleural cavity: b/w visceral & parietal pleura. Contains fluid for reducing friction.

23. Mediastinum

Interpleural space in the thorax. Bounded: by lateral: pleural cavities. Post: by vertebral column. Ant: by sternum

Divided by sternal angle to superior and inferior mediastinum

Sup mediastinum: contain trachea, brachiocephalic v, thymus, aortic arch, esophagus, thoracic duct, sup vena cava.. innervations: vagus nerve, left recurrent laryngeal nerve and phrenic

Inferior mediastinum: anterior med: small vessels, connective fatty tissue, thymus in the child, lymph nodes. lies anterior to pericardium & posterior to sternum

Middle: heart, ascending aorta, pulmonary trunk, pulmonary veins, phrenic n., arch of azygos v. & main bronchii.

b/w right and left pleural cavity.

Posterior mediastinum: esophagus with vagus n, descending aorta, thoracic duct, sympathetic trunks, hemiazygos vein, splachnic n. posterior to pericardium b/w mediastinal pleurae.

24. KIDNEY

The kidneys are bean shaped retroperitoneal organs weighing about 120g and are redish-brown in color. They are located in the lumbar region on both sides of the vertebral column between L1 to L4. The kidneys are tilted so the superior pole is closer to the vertebral column than the inferior pole. They have a round anterior surface and a flat posterior one. The 2 surfaces meet at lateral and medial margins. The medial margin has the hilum in its center. They also have superior and inferior poles.

Right kidney: Lower compared to the L. kidney because it is situated below the large right lobe of the liver.

Anterior associations: suprarenal area – superior. associated with the suprarenal gland, hepatic area – superior lateral. associated with R. lobe of the liver, colic area – inferior lateral, associated with ascending colon and R. colic flexure. Duodenal area – medial

Posterior associations: 12th rib crosses it's superior pole, Diaphragm – superior, Psoas major m. – median, Quadratus lumborum m. – medial, Transversus abdominis m. (aponeurosis) – lateral

Left kidney

Anterior associations: suprarenal area – superior. associated with the suprarenal gland, gastric area – below suprarenal, splenic area – lateral to gastric, pancreatic area – below gastric, jejunal area – inferior, colic area – lateral to jejunal.

Posterior associations: 12th rib divided it to an upper 1/3 and a lower 2/3, The muscles associated with it are the same as the ones for the R. kidney.

The kidneys are surrounded by 3 layers: Fibrous renal capsule, Adipose capsule – called perirenal fat. Mesh filled with adipose cells. Renal fascia.

Medulla – inner region composed of 10-12 renal pyramids and renal columns between them. The pyramids contain millions of collecting ducts that open into the minor calyces.

Cortex – the outer part of the kidney. Sends projections into the medulla called renal columns. Contains renal corpuscles (part of the nephron). Also contains collecting ducts called medullary rays that divide it into cortical lobules.

Blood Supply: Abdominal aorta → renal a. → Ant. & Post. branches → segmental aa. → interlobar aa. → arcuate a. → interlobular aa. → afferent arterioles → renal glomerular capillaries → efferent arterioles → peritubular capillaries → interlobular vv. (stellate vv.) → arcuate vv. → interlobular vv. → Ant. & Post branches → renal v. → IVC

Nerves: Innervated by fibers from the renal plexus.

25. RENAL CALICES, RENAL PELVIS, URETER

Renal calices: The first unit in the system of ducts in the kidney carrying urine from the renal pyramid of the medulla to the renal pelvis for excretion through the ureters. There are two divisions: the minor renal calyx, with several others, drains into a larger major renal calyx, which in turn joins other major calyces to form the renal pelvis.

The major calyx, in the kidney, surrounds the apex of the malpighian pyramids. Urine formed in the kidney passes through a papilla at the apex into a minor calyx then into major calyx before passing through the renal pelvis into the ureter.

The minor calyx, in the kidney, surrounds the apex of the malpighian pyramids. Urine formed in the kidney passes through a papilla at the apex into the minor calyx then into the major calyx.

Renal pelvis: Is the funnel-like dilated proximal part of the ureter in the kidney. Is the point of convergence of two or three major calyces. Each renal papilla is surrounded by a branch of the renal pelvis called a calyx. The major function of the renal pelvis is to act as a funnel for urine flowing to the ureter. The renal pelvis is the location of several kinds of kidney cancer.

Ureter: Approximately 25cm in length it runs down the abdominal wall anterior to the psoas major m. and posterior to the gonadal a. and v. At the entrance to the lesser pelvis it passes anteriorly to the common iliac a. and v. Lastly the ureter passes posteriorly to the vas deference in males or the uterine artery in females. Then it enters obliquely into the urinary bladder through the ureter orifices. Arise from the renal pelvis on the medial aspect of each kidney before descending towards the bladder on the front of the psoas major muscle. The ureters cross the pelvic brim near the bifurcation of the iliac arteries. In females, the ureters pass through the mesometrium and under the uterine arteries on the way to the urinary bladder.

Blood: Branches from the renal aa, aorta, gonadal aa, common iliac aa, internal iliac aa. inferior vesicle aa, and more.

26. URINARY BLADDER

Located in the pelvis behind the pubic symphysis, it is infraperitoneal and the peritoneum forms the rectovesical pouch behind it in males and the vesicouterine pouch in females. When it is full it expands over the level of the symphysis.

The bladder has an apex, body, fundus, and neck that continues into the urethra.

When empty the inner side of the bladder has many folds. One section that remains smooth is the trigone. This is a triangular shaped area that extends from the 2 orifices of the ureters, uterine orifices, and the internal urethral orifice. Between the 2 ureter orifices there is the interureteric fold and at the angle of the urethra there's a protrusion called uvula vesicae. The origin of the trigone is mesodermal as opposed to the rest of the bladder which is endodermal. Contains between 300-500ml of urine.

Muscles - smooth. The bladder is covered by the vesical fascia: Detrusor m, Pubovesicalis m., Rectovesicalis m., Median umbilical lig., Medial/ umbilical lig.

Blood: Sup. vesical a. ← umbilical a. ← internal iliac a. Inf. vesical a. ← internal iliac a. Vesical venous plexus → sup. and inf. vesical vv. → internal iliac v.

Nerves: Vesical and prostatic plexuses. Parasympathetic. Sympathetic.

27. MALE AND FEMALE URETHRA

Originates at the urethral orifice of the urinary bladder.

Is a tube that connects the urinary bladder to the genitals for removal out of the body. In males, the urethra travels through the penis, and carries semen as well as urine. In females, the urethra is shorter and emerges above the vaginal opening.

The external urethral sphincter is a striated muscle that allows voluntary control over urination.

In males it is long (20cm), S-shaped and divided into 5 areas: Intramural part – area inside the wall of the urinary bladder. Prostatic part – area that goes through the prostate – elevated region colliculus. Free part – between the prostate and the urogenital diaphragm. Membranaceous part – small section that goes through the urogenital diaphragm. Spongy (penile) part - the area that runs in the spongy part of the penis and opens at the glands penis. Bulbourethral.

The female urethra is much shorter (4-5cm) lined by stratified squamous epithelium and some areas with pseudostratified columnar epithelium.

Exits the body between the clitoris and the vagina, extending from the internal to the external urethral orifice. It is placed behind the symphysis pubis, embedded in the anterior wall of the vagina, and its direction is obliquely downward and forward. It is slightly curved with the concavity directed forward. Between the superior and inferior fascia of the urogenital diaphragm, the female urethra is surrounded by the urethral sphincter. Pudendal nerve.

28. TESTIS, EPIDIDYMIS, SCROTUM

Testis (orchis): 4-5 cm long plum shaped paired organ that develops on the posterior abdominal wall at the L1 level and then descend through the inguinal canal into the scrotum. Retroperitoneal. It produces spermatozoa (sperm cells) and secretes the hormones testosterone (Leydig's interstitial cells) and inhibin (Sertoli's cell)

The left testis is larger and lower compared to the right one.

Blood: testicular a. ← abdominal aorta (supply testis and head of epididymis), L. testicular v. → Renal vein, R. Testicular v. → IVC, Pampiniform plexus (in spermatic cord) → testicular v.

Lymph: lumbar lymph nodes → R/L lumbar trunks → cisterne chyli

Nerve: Testicular plexus ← aortic sympathetic plexus

Epididymis: Located on the posterior margin of the testicles. It stores the sperm cells (spermatozoa). Has a head body and tail and continues into the vas deferens.

Blood: Head - testicular a. ← abdominal aorta, Body& tail - deferential a. ← int. iliac a., Veins drained by pampiniform plex. (testicular vein).

Lymph: Lumbar lymph nodes, Iliac & sacrum lymph nodes

Nerve: Deferential plex. Aortic plexus (symp.) Sacral plexus (parasym.)

Scrotum: Keeps the testis 3 degrees lower then the body. There is a scrotal septum that separates the 2 testis. The scrotum is elevated by the cremaster m. This muscle is important in neuronal investigation. It is innervated by nerves from the lumbar plexus and when you touch the inner side of the thigh the testis on that side elevates.

Blood: Ant. scrotal aa. ← external pudental aa. Post. scrotal aa. ← internal pudental aa. Cremasteric aa. ← Inf. epigastric aa. Veins go along the arteries and have the same names

Lymph: Superficial inguinal lymph nodes

Nerves: Ant. scrotal nn. - lumbar plexus. Post. scrotal nn. - sacral plexus

29. SPERMATIC CORD, DUCTUS DEFERENS

Vas deferens: called ductus deferens, is part of the male anatomy of many vertebrates; they transport sperm from the epididymis in anticipation of ejaculation.

There are two ducts, connecting the left and right epididymis to the ejaculatory ducts in order to move sperm. Each tube is about 30 centimeters long and is muscular. They are part of the spermatic cords. Ascends in the spermatic cord through the inguinal canal. Then continues medially to the posterior surface of the urinary bladder and then joins with the seminal vesicle duct to form the ejaculatory duct. Before joining with the seminal vesicle there is a region where the duct is wider and it is called the ampulla. The ejaculatory duct extend through the prostate and opens into the prostatic urethra. The sperm continues from the epididymis to the vas deferens.

Blood: Vas deferens a. ← sup. vesicle a. Terminal part – testicular / prostatic venous plexus. For the rest – testicular vv.

Lymph: Vas deferens lymph vessels → ext. iliac lymph nodes → lumbar (caval/aortic)

Spermatic cord: the cord-like structure in males formed by the ductus deferens and surrounding tissue that run from the abdomen down to each testicle.

arteries: testicular artery, deferential artery, cremasteric artery

nerves: nerve to cremaster (genital branch of the genitofemoral nerve), testicular nerves (sympathetic nerves)

vas deferens (ductus deferens)

Nerves: pampiniform plexus

lymphatic vessels

tunica vaginalis (remains of the processus vaginalis)

The pampiniform plexus, testicular artery, artery of the ductus deferens, lymphatic vessels, testicular nerves, and ductus deferens all run deep to the internal spermatic fascia.^[1] The genital branch of the genitofemoral nerve,^[1] cremasteric artery, and ilioinguinal nerve all run on the superficial surface of the external spermatic fascia.

The spermatic cord is ensheathed in three layers of tissue: external spermatic fascia, an extension of the innominate fascia that overlies the aponeurosis of the external oblique muscle, cremasteric muscle and fascia, formed from a continuation of the internal oblique muscle and its fascia, internal spermatic fascia, continuous with the transversalis fascia.

30. PROSTATE, SEMINAL VESICLES

Seminal vesicle: Accessory gland. Highly convoluted tubulated paired glands behind the bladder, their ending called excretory duct joins the ampulla of the vas deferens. The 2 together form the ejaculatory duct that opens into the urethra, at the seminal colliculus (an elevated region). The glands produce a viscous yellow fluid that makes up 70% of the total volume of ejaculate. The fluid activates the spermatozoa and give it energy (fructose). Each seminal gland spreads approximately 5 cm, though the full length of seminal vesicle is approximately 10 cm, but it is curled up inside of the gland's structure. Each gland forms as an outpocketing of the wall of ampulla of each vas deferens. The excretory duct of seminal gland opens into the vas deferens as it enters the prostate gland.

Blood: Internal pudental a., inferior vesical a., middle rectal a. Prostatic venous plexus, pudental plexus, vesicle plexus, internal iliac v.

Lymph: Seminal glands → iliac lymph nodes. Sup, part → external iliac nodes. Inf. part → internal iliac nodes

Nerve: inferior hypogastric plexus

Prostate: Largest accessory gland in males. Located under the urinary bladder has a superior base and an inferior apex. Its posterior side can be palpated through the rectum. It is incompletely divided into lobes by the urethra and the ejaculatory ducts. It is 2/3 glandular and 1/3 fibromuscular. It opens into the urethra that passes through it. It is larger than a walnut. In actuality, it is approximately the size of a kiwifruit. The mean weight of the "normal" prostate in adult males is about 11 grams, usually ranging between 7 and 16 grams. It surrounds the urethra just below the urinary bladder.

Blood: Branches of inferior vesicle a., interior pudental a., inferior rectal a. Prostatic venous plexus → internal iliac vv.

Lymph: Sacral and internal iliac nodes

Nerve: Branches from the inf. hypogastric plexus.

Anterior lobe (or isthmus) → roughly corresponds to part of transitional zone. Posterior lobe → roughly corresponds to peripheral zone. Lateral lobes → spans all zones. Median lobe (or middle lobe) → roughly corresponds to part of central zone

31. MALE EXTERNAL GENITALIA

The male external genitalia refers to the portion of the male reproductive system consisting of penis, urinary tract, and scrotum.

Penis: is composed of erectile tissues. There are 2 cavernous bodies that originate at the ischial ramus and are called crus of penis. They make the dorsal side of the penis and are covered by the ischiocavernosus m. until they fuse together. Each cavernous body has a deep a. that runs in its center and there are 2 dorsal aa. that run dorsally to the bodies. The spongious body originated at the urogenital diaphragm. It has an enlarged area close at the origin called the bulb of penis that is covered by the bulbospongiosus m. The spongious body runs between the 2 cavernous bodies on the ventral side of the penis and it enlarges at the end to form the glans penis. The urethra runs in its center. It is a reproductive organ.

Artery: dorsal a. of the penis, deep a. of the penis, a. of the urethral bulb

Vein: dorsal vv. Of the penis

Nerve: Dorsal penile n. ← pudental n.

Lymph: superficial inguinal lymph nodes

Urinary system: The urinary system (also called the excretory system) is the organ system that produces, stores, and eliminates urine. In humans it includes two kidneys, two ureters, the bladder, the urethra, and two sphincter muscles.

Scrotum: Keeps the testis 3 degrees lower than the body. There is a scrotal septum that separates the 2 testis. The scrotum is elevated by the cremaster m. This muscle is important in neuronal investigation. It is innervated by nerves from the lumbar plexus and when you touch the inner side of the thigh the testis on that side elevates.

Artery: anterior scrotal a., posterior scrotal a.

Vein: testicular v.

Nerve: posterior nn., anterior scrotal nerves, genital branch of genitofemoral n., perineal branches of posterior femoral cutaneous n.

Lymph: inguinal lymph nodes.

32. OVARY

Almond-shaped bodies 3cm long and 1.5cm wide. It produces oocytes and has an endocrine function (estrogene, progesterone, relaxin). The **ovary** is an ovum-producing reproductive organ, often found in pairs as part of the vertebrate female reproductive system. Ovaries in females are homologous totestes in males, in that they are both gonads and endocrine glands. Ovaries are oval shaped . The ovary (for a given side) is located in the lateral wall of the pelvis in a region called the ovarian fossa. The fossa usually lies beneath theexternal iliac artery and in front of the ureter and the internal iliac artery. The ovaries aren't attached to the fallopian tubes but to the outer layer of the uterus via the ovarian ligaments. Usually each ovary takes turns releasing eggs every month; however, if there was a case where one ovary was absent or dysfunctional then the other ovary would continue providing eggs to be released

Extremities: The end to which the uterine tube attaches is called the *tubal extremity*. The other extremity is called the *uterine extremity*. It points downward, and it is attached to the uterus via the ovarian ligament.

Hormones: Ovaries secrete both estrogen and progesterone.

Peritoneum and ligaments: covered by mesovarium. Ovarian ligament – attaches the ovary to the uterus.

Suspensory ligament – not a real ligament, the ovarian vessels run in it.

Blood: Ovarian a., R. ovarian v., L. ovarian v.

Nerve: ovarian plexus

Lymph: lumbar lymph nodes

33. UTERINE TUBE

The tubes start with a uterine orifice at the junction with the uterus that continues into the first narrow part of the tube that is called the isthmus. It then turns into a wider section called ampulla and into a funnel shaped infundibulum that ends with finger like projections called fimbriae. The opening at the infundibulum is called the abdominal ostium. The tubes follow the posterior wall of the pelvis.

The Fallopian tubes, also known as oviducts, uterine tubes, and salpinges are two very fine tubes lined with ciliated epithelia, leading from the ovaries of female mammals into the uterus, via the utero-tubal junction. In non-mammalian vertebrates, the equivalent structures are the oviducts.

In a woman's body the tube allows passage of the egg from the ovary to the uterus. The tubal ostium is the point where the tubal canal meets the peritoneal cavity, while the uterine opening of the Fallopian tube is the entrance into the uterine cavity, the utero-tubal junction. Ovaries are also connected to the urinary bladder.

Peritoneum and ligaments: Held in place and covered by the mesosalpinx.

Blood: Tubarian branches from uterine a. and ovarian a.

Lymph: lumbar lymph nodes

34. UTERUS

The uterus is a triangular organ with 3 major areas: the upper fundus, middle corpus, and a lower cervix. The area where the corpus narrows into the cervix is called isthmus (narrowing) of uterus. The cervix has 2 openings called internal and external os. The cervix opens into the vagina and it is at a special angle to it called anteversion and the fundus of the uterus is at an angle called anteflexion. When the uterus bends in the opposite direction it is called retroflexion. The uterus is located inside the pelvis immediately dorsal (and usually somewhat rostral) to the urinary bladder and ventral to the rectum. The human uterus is pear-shaped and about 3 in. (7.6 cm) long. A female's uterus can be divided anatomically into four segments: The fundus, corpus, cervix and the internal os.

Layers: Endometrium, Myometrium, Perimetrium, Peritoneum

Peritoneum and ligaments: The part of the broad ligament that covers the uterus is called mesometrium.

Pubovesical lig. Rectouterine m. Round lig. Cardinal lig. – not a true ligament.

Blood: Uterine aa. Anastomoses with ovarian aa.

Veins: uterine veins

Lymph: Internal iliac lymph nodes (Body and cervix), paraaortic lymph nodes (Fund

35. VAGINA

At the junction of the cervix and the uterus there is a fold called the vaginal fornix. The **vagina** is a fibromuscular tubular tract leading from the uterus to the exterior of the body in female placental mammals and marsupials, or to the cloaca in female birds, monotremes, and some reptiles. Female insects and other invertebrates also have a vagina, which is the terminal part of the oviduct. Called vulva or female genitals generally (internal structure). The length of the unaroused vagina of a woman of child-bearing age is approximately 6 to 7.5 cm (2.5 to 3 in) across the anterior wall (front), and 9 cm (3.5 in) long across the posterior wall (rear). The vagina connects the superficial vulva to the cervix of the deep uterus.

Arteries: Branches from the uterine a. middle rectal a. and the internal pudendal.

Veins: vaginal vein

Nerves: sympathetic (lumbar splanchnic plexus), parasympathetic (pelvic splanchnic plexus)

Lymphs: internal iliac lymph nodes, superficial inguinal lymph nodes

Paracysticum – tissue beside to urinary bladder. Paracolpium – a tissue beside to vagina. Paraprocticum – beside to rectum. Periprocticum – around the rectum

36. FEMALE EXTERNAL GENITALIA

External genital organs: Labia majora – hair, fat tissue, sebaceous glands. Labia minora – no hair, no fat tissue, no sebaceous glands. Clitoris – parallel to the glans penis. Bertolini's glands – below UG diaphragm open into the vestibule, lubricate the vagina.

Labia majora are lip-like structures consisting mostly of skin and adipose tissue, which extend on either side of the vulva to form the cleft of venus through the middle.

When standing or with the legs together, they usually entirely or partially cover the other parts of the vulva. Protection is the main function.

Labia minora (nymphae) are two soft folds of skin between the *labia majora* and to either side of the opening of the vagina. The clitoris is anterior to the vulva where the *labia minora* meet superiorly. The visible tip of the clitoris, the clitoral glans, is entirely or partially covered by a "hood" of tissue (the clitoral hood). During sexual arousal, the labia minora become engorged with blood, typically swelling slightly and darkening or reddening in color.

Clitoris: The visible button-like portion is located near the anterior junction of the labia minora, above the opening of the urethra and vagina. The clitoris does not contain the distal portion of the urethra. The head or glans of the clitoris is roughly the size and shape of a pea, although it can be significantly larger or smaller. The clitoris is a complex structure, with both external and internal components. Projecting at the front of the labial commissure where the edges of the outer lips (labia majora) meet at the base of the pubic mound is the clitoral hood (prepuce), which in full or part covers the head (clitoral glans). Following from the head back and up along the shaft, it is found that this extends up to several centimeters before reversing direction and branching.

Urethra: Is a tube that connects the urinary bladder to the genitals for removal out of the body. In males, the urethra travels through the penis, and carries semen as well as urine. In females, the urethra is shorter and emerges above the vaginal opening.

The external urethral sphincter is a striated muscle that allows voluntary control over urination.

37. PERINEUM

A diamond shaped area at the base of the lesser pelvis that is bordered by the pubic symphysis, the coccyx and the R. and L. ischial tuberosities. The superficial transverse perineal m. extends from the one ischial tuberosity to the other and divides the perineum into 2 triangular regions, the anal and the urogenital regions. The perineum corresponds to the outlet of the pelvis. The perineum is the region of the body inferior to the pelvic diaphragm and between the legs. It is an erogenous zone for both males and females

Boundaries: In front: the pubic arch and the arcuate ligament of the pubis. Behind: the tip of the coccyx.

On either side: the inferior rami of the pubis and ischial tuberosity, and the sacrotuberous ligament

Pelvic diaphragm: Funnel shaped floor of the lesser pelvis. Composed of the levator ani m., the coccygeus m. and their fascias. The levator ani m. originates at the pelvic rim and ends (not a real insertion) at the anal hiatus where it forms the external anal sphincter. On the anterior side the levator ani m. has another hiatus called the urogenital hiatus that is partially closed by transverse muscle fibers of the deep transverse perineal m. belonging to the urogenital diaphragm. There is a space between the levator ani muscle and the internal obturator m. called the ischioanal (rectal) fossa that is filled with fat.

Internal pudental a. and v. and the Pudental n.

Urogenital diaphragm: located below the pelvic diaphragm only in the anterior (urogenital) portion of the perineum. It is composed mainly by the deep transverse perineal m. and its fascias

Urogenital triangle → the anterior triangle, in females contains the vagina

Anal triangle → the posterior triangle, contains the anus

1. General anatomy of blood vessels

Blood vessels: carry blood to the lungs, -CO₂ is exchange for O₂. Carry blood to the intestines where nutritive materials in fluid form are absorbed. Transport the waste products to the kidneys, intestines, lungs & skin.

Arteries: carry blood away from heart to parts of body. Have thicker and stronger elastic wall than veins. Elastic, muscular & arterioles.

Veins: carry blood toward the heart from all parts of body. Consist of pulmonary veins which return O₂ blood to the heart. Return CO₂ blood to the heart.

Capillaries: composed of endothelium & connect arterioles to venules. Site for gas exchange for CO₂, O₂, nutrients, waste products b/w tissues and blood.

Layers: tunica intima (intermost), tunica media, tunica adventitia.

Sinusoids: wider and more irregular than capillaries. Phagocytic cells on walls.

2. The heart- external features.

Located at middle mediastenum. Pericardium: fibrous outer, inner serous.

Fibrous sac formed by collagenous connective tissue with dense fibers surrounding the heart, surrounded with tunica ad.

Serous: dual layer closed system with fibrous: parietal & visceral epicardium.

Anterior: sternocostal surface formed by: anterior wall of ventricle, wall of left ventricle, apex of heart.

Right side: right atrium & superior vena cava.

Left side: left auricle, left ventricle

Pulmonary trunk: arises from left ventricle, lies to aorta.

Aorta: ascending aorta-> aortic arch

Diaphragmatic surface-> formed by left ventricle separated from left atrium by coronary sulcus.

Layers: epicardium(by visceral and serous pericardium) myocardium(thick cardiac m) endocardium: internal layer.

3. Cardiac chambers-internal features

Right atrium: superior vena cava, inferior vena cava, pectinate muscles, interatrial septum, valve of foramen ovale.

Right ventricle: tricuspid valve, ant&post papillary m. pulmonary trunk, trabecular canal.

Left atrium: right and left pulmonary veins, ant&post. Casps, valve of foramen ovale.

Left ventricle: bicuspid valve, inflow tract: papillary m. outflow tract: aortic valve, interventricular septum.

Heart valves: pulmonary valve: left, open by ventricular systole, close slightly after closure of aortic valve.

Aortic valve: right, close during ventricular systole.

Tricuspid: right av, close during ventricular systole

Bicuspid: left av valve, or mitral. Closed slightly before tricuspid valve by systole.

4. Structure of cardiac wall

myocardium atrial muscle-soft & deep layer. Ventricular muscle-subepicardial layer. At apex from vortex of heart. Lv has a thick middle muscular layer. Subendocardial layer. Coronary sulcus, ant & post.

Interventricular sulcus.

Endocardium: covers the inner surface of myocardium, consist of endothelial layer& connective tissue

Epicardium: outer surface of myocardium, smooth& shiny.

5. Systemic and pulmonary circulation

Systemic circulation: carries O₂ blood away from heart to the body. Returns deoxygenated blood back to heart. Maintain homeostasis. LA->LV->aorta->right common iliac arteries-> smaller arteries->capillaries->small veins->common iliac veins->IVC-> RA->RV->pulmonary arteries->lungs->pulmonary vein->heart.

Pulmonary circulation: carries O₂ depleted away from heart to lungs. Returns O₂ blood back to heart.

Heart->lungs>heart->pulmonary artery->RV->capillaries->alveoli->pulmonary vein->heart->LV.

Pulmonary a: oxygen poor blood away.

Pulmonary v.: oxygen rich blood to heart.

6. Conductive system of heart, nerves of heart

By specialized cardiac muscle cells that generate & conduct rhythmic impulses that stimulate heart beating. Working myocardium. Cells arranged in bundles divided into: atrioventricular groove, right bundle, left bundle.

Sinatrial node: upper epicardium, near superior vena cava in sulcus terminalis.

Atrioventricular node: b/w coronary sinus-triscupid valve

Impulses from sinatrial node travel through myocardium of right atrium to right ventricle->atrioventricular bundle.

Right bundle: ant capillary m. & subendocardial branches

Left bundle: base of papillary muscles.

Nerves of heart. Sympathetic & parasympathetic innervations

Superior, middle & inf cervical cardiac nerves.

Parasympathetic arise from vagus nerve. sup & inf cardia branches, cervical plexus

Splachnic nerve: greater, lesser & least splachnic nerves: through diaphragm

Phrenic n: from c3-4-5 cervical plexus. Runs in front of anterior scalene muscle.

Vagus n : right vagus n b/w r brachiocephalic veni and trunk.

Left vagus N : b/w L brachiocephalic & subclavian v. Recurrent branches: right & left recurrent laryngeal n.

7. Arteries and veins of heart

Right coronary a: supplies right atrium, enters into coronary sulcus, on right side : covered by right auricle.->giving right marginal a. & post interventricular a.

Left coronary a.: passes b/w pulmonary trunk & left auricle. Divides into anterior interventricular a & circumflex a.

Supplies left ventricle, part of right ventricle at sternocostal surface of heart & left atrium.

Coronary veins: anterior interventricular vein, great cardiac vein(in left coronary sulcus). Middle cardiac vein(post interventricular sulcus), small cardiac vein.

8. Thoracic aorta

Begins at 4th thoracic vertebra-> cont with aortic arch ends at lower border of 12 TV in diaphragm, then becomes abdominal aorta. Branches: right pulmonary, brachiocephalic, left common carotid, subclavian, mediastinal, esophageal, pericardial, sup phrenic.

9. Abdominal aorta

Branches: inf phrenic a, celiac trunk, sup inf middle suprarenal, renal, sup inf mesenteric, aortic bifurcation, common external internal iliac a, median sacral, ovarian/testibular, lumbar a.

Paired: renal, middle suprarenal, ovarian/testibular

Unpaired: celiac trunk, sup and inferior mesenteric a.

10. External carotid artery

A major artery of head and neck, arises from common carotid a, bifurcates into internal & external carotid a.

Branches: superior thyroid a, lingual, facial, ascending pharyngeal, occipital (sternocleidomastoid branch, descending branch), post auricular a, maxillary a, sup temporal a.

11. Internal carotid artery

Major a of the head & neck that supply blood to brain. Divides in the brain into ant & middle cerebral a. enters the cranium through carotid canal.

Branches: ophthalmic, post communicating, ant choroidal, ant middle cerebral a.

12. Arteries of brain

Internal carotid a : ophthalmic, post communicating, ant choroidal, ant & middle cerebral.

Vertebral a.: ant post spinal a, post inf cerebellar

Basilar : pontine, labyrinthine, ant inf post sup cerebellar

Circle of willis: formed by : pst cerebral , post anterior communicating, internal carotid, ant cerebral a.

13. Subclavian artery

Branch of brachiocephalic trunk. Arises from arc of aorta.

Branches: vertebral, thyrocervical trunk (inf thyroid, transverse cervical, suprascapular), internal thoracic, costocervical trunk (deep cervical, sup intercostal a.), dorsal descending scapular a

14. Axillary artery, brachial artery

Axillary artery: central structure of axilla, border in its medial side by axillary vein, extends from anterior border of 1st rib to inf border of teres major muscle-> becomes brachial artery. Divided into 3 parts by pectoralis minor m.

Part 1: superior or supreme thoracic a. Part 2: thoracoacromial , lateral thoracic. Part 3: subscapular (thoracodorsal, circumflex scapular a), ant circumflex a, post humeral circumflex a.

Brachial artery: extends from inf border of teres major m. to its bifurcation in the cubital fossa. Divide into radial and ulnar a at the level of radial neck of cubital fossa.

Branches: profunda brachii (radial collateral, middle collateral). Sup ulnar collateral, inf ulnar collateral (radial, ulnar).

15. Forearm arteries, hand arteries

Radial a: arises from branch of brachial a in cubital fossa, descends laterally , pass through anatomical snuff box

Branches: radial recurrent, palmar carpal branch, spfc palmar branch, dorsal carpal branch, princeps pollicis a, radialis indicis a, deep palmar arch-> 3 metacarpal a.

Ulnar a: longer med branch of brachial a in cubital fossa. Enters hand to flexor retinaculum. Divides into spfc & deep palmar arch. Branches: ant & post ulnar recurrent, common interosseus (ant & post), palmar carpal branch, dorsal carpal branch, spfc palmar arterial arch, deep palmar branch.

16. Internal iliac artery

Arises from bifurcation of common iliac a. divided into posterior division and anterior division

Branches: iliolumbar, lateral sacral, inf & sup gluteal, internal pudental, umbilical, obturator, inf vesical-vaginal, middle & rectal, uterine a (a of ductus deferens, sup branch, vaginal branch.)

17. External iliac artery, femoral artery

Large a in pelvic region-carries blood to lower limb. Paired artery (right & left external iliac a). accompanied by external vein. Arise from bifurcation of common iliac a. Branches: inferior epigastric a, deep circumflex, femoral a.

Femoral a: continuation of external iliac a. has a palpable pulsation, vulnerable to injury-superficial. Branches: superficial epigastric, superficial circumflex, superficial & deep external pudental, profunda femoris, medial femoral circumflex (muscular branches, acetabular, ascending, transverse, cruciate anastomosis), lateral femoral circumflex a (transverse branch, descending, cruciate anastomosis.) descending genicular a (articular & saphenous branch).

18. Arteries of leg, arteries of foot

Popliteal a: continuation of femoral a. give rise to 5 genicular a: sup lat genicular, superior medial genicular, inferior medial & lateral genicular, middle genicular & sural a.

Post tibial a.: arises from popliteal a. give rise to peroneal, post lat malleolar branch. Terminate into medial & lateral plantar

Branches: post recurrent tibial a, peroneal a.

Anterior tibial a: ant recurrent tibial a, ant middle & lateral malleolar a.

Dorsalis pedis: medial & lateral tarsal a., arcuate, dorsal metatarsal, perforating branches.

Plantar a: medial & lateral plantar a (deep & superficial), plantar arch (deep), plantar metatarsal a → proper plantar digital a, perforating branches.

19. Coeliac trunk

Descending aorta → coeliac trunk → common hepatic artery → proper hepatic artery, gastroduodenal artery, superior pancreaticoduodenal artery, superior mesenteric artery, right gastroepiploic artery, left gastroepiploic artery → splenic artery → left gastric artery → short gastric arteries

20. Superior mesenteric artery

Arises from aorta behind neck of pancreas.

Branches: Inferior pancreaticoduodenal artery → middle colic artery (right branch anastomoses with right colic artery, left branch anastomoses with left colic artery) → ileocolic artery (ascending colic artery anastomoses with right colic artery, appendicular artery, cecal artery) → right colic artery → intestinal arteries (12 – 15 in number)

21. Inferior mesenteric artery

Supplies descending colon, sigmoid colon and upper rectum.

Branches: left colic artery (ascending and descending branches) → sigmoid arteries → superior rectal artery (termination)

22. Superior vena cava

Returns blood from all structures superior to the diaphragm, except lungs and heart.

Branches: azygos vein → Right and left brachiocephalic veins → internal jugular vein → external jugular vein → subclavian vein → right lymphatic duct → thoracic duct → middle thyroid vein → left superior intercostals vein → internal thoracic vein → left inferior thyroid vein → anterior jugular vein → oesophagus → hemiazygos vein → accessory hemiazygos vein (4th -8th left intercostal space) → right intercostal vein (2nd and 3rd intercostals space) → subcostal vein → lumbar veins

Receives: esophageal veins, mediastinal veins, bronchial veins, superior phrenic veins, pericardial veins.
→ Internal thoracic – anterior intercostals veins, azygos vein – intercostals veins.

23. Inferior vena cava

Longer than abdominal aorta and ascends along the right side of aorta.

Carries deoxygenated blood from the lower half of the body into the Right atrium of heart.

Receives: right gonadal vein, suprarenal vein, inferior phrenic vein, right and left renal veins, hepatic portal veins (left, middle, right)

Branches: inferior phrenic vein (right and left) → Hepatic veins (right, middle, left) → suprarenal veins (left and right) → renal veins (left and right) → gonadal vein → lumbar veins → common iliac veins (left and right) → internal and external iliac veins → middle iliac vein → right and left testicular ovarian veins.

24. Superficial veins of upper limb and lower limb

Upper limb: Cephalic vein: connected with basilica vein by the media cubital vein at elbow. Empties into axillary vein. **Basilic vein:** arises from the dorsal venous arch. Joins two brachial veins and form the axillary vein. **Median cubital vein:** connect cephalic and basilica veins. Lies to bicipital aponeurosis. **Median antebrachial vein:** arises in the palmar venous network terminates in the median cubital/ basilica vein. **Dorsal venous network:** receives dorsal digital veins. Receives palmar digital veins. Continuous proximal as cephalic and basilic vein.

Lower limb: Great saphenous vein: begin at the medial end of the dorsal venous arch of the foot, ascends in front of medial malleolus, passes through saphenous opening (fossa ovalis), pierces femoral sheath and join femoral vein. Receives: external pudental, superficial epigastric, superficial circumflex ilia, lateral femoral cutaneous, accessory veins. Use for coronary artery bypass surgery and for venipuncture.

25. Internal jugular vein

Begins in jugular foramen. Descends in the carotid sheath. Ends in the brachiocephalic vein, has superior and inferior bulb. Receives: the facial vein, lingual vein, superior and middle thyroid vein. Collects blood from brain.

26. Dural venous sinuses

Formed by dura matter. Most veins of the brain into the intracranial dural venous sinuses. Superior and inferior sagittal sinuses. Superior and straight and occipital sinuses join at the confluence → drained by transverse sinuses. Transverse sinus drains into sigmoid sinus. Cavernous sinus → located in each side of the sella turcica. Communicates with ophthalmic vein, pterygoid venous plexus, facial vein. Contains the adjacent nerve and internal carotid artery.

27. Hepatic portal vein, anastomoses between portal and systemic circulation

Portal vein: formed by union of 3. **[a] Splenic vein** (short gastric veins, left gastroepiploic vein, pancreatic vein). **[b] Superior mesenteric vein** (pancreaticoduodenal vein, middle and right colic vein, iliocolic vein, intestinal veins). **[c] Inferior mesenteric vein** (left colic vein, superior rectal vein, superior rectal vein, sigmoid veins).

Porto – caval (systemic) anastomoses: it is where the portal hepatic veins join with systemic venous system (superior and inferior vena cava).

[a] Esophagous: gastric veins (portal) + esophageal vein (azygos) → hemiazygos vein → superior vena cava → esophageal varices.

[b] Abdominal wall: paraumbilical veins (portal) + small epogastric (systemic) → thoracoepigastric → superior vena cava → caput Medusae.

[c] Rectum: superior rectal vein (inferior mesenteric – portal) + middle and inferior rectal veins → internal iliac and inferior pudental → inferior vena cava → hemorrhoids.

28. General description of lymphoid system

Immune mechanism for the body, involved in the metastasis of cancer cells, transport fat and large protein molecules absorbed from the intestine to thoracic duct.

Lymphatic vessels: not visible, have valves, absorb large protein molecules transport them to bloodstream. Carry lymphocytes from lymphatic tissues to bloodstream. Absent in brain, spinal cord, eyeballs, bone marrow, splenic pulp, hyaline cartilage, nails, hair.

Lymphatic capillaries: absorb lymph from tissue spaces and transport it back to the venous system. Called lacteals in the villi of small intestine.

Lymph nodes: produce lymphocytes and plasma cells and filter the lymph. Ingest bacteria.

Lymph: clear watery fluid collected from intercellular spaces. No cells, contains fat droplets (chyle). Filtered before passing the venous system.

29. Spleen

Lymphoreticular organ. Intraperitoneal. Blue/ red organ, soft, 3-4 cm long, 200g. Diaphragmatic and visceral surfaces.

Consists of: superior border, inferior border, posterior and anterior extremity, gastrosplenic and splenorenal ligament, splenic artery, splenic vein. Held in position by phrenicocolic ligament. Splenic hilum is the area where the vessels divide visceral into upper and lower region. Posterior to hilum touches left kidney. Anterior to hilum is the stomach and tail of pancreas. From hilum to greater curvature of stomach → short gastric arteries and veins and left gastroepiploic artery. Shorter to diaphragm → splenic artery and vein.

30. Lymph nodes of head and neck

Superficial lymph nodes of the head: lymph vessels from face, scalp, ear → drain into occipital, retroauricular, parotid, buccal, submandibular, submental, superficial cervical nodes → drain into deep cervical nodes.

Deep lymph nodes of the head: retropharyngeal, upper deep cervical nodes, submandibular, submental, lower deep cervical, prelaryngeal, pretracheal, paratracheal nodes.

Superficial cervical lymph nodes: lie along the external jugular vein in the posterior triangle and anterior jugular vein in anterior triangle. Drain into the deep cervical nodes.

Deep cervical lymph nodes: **[a] superior deep cervical nodes:** lie along the internal jugular vein in the carotid triangle of neck. Receive afferent lymphatics from the back of the head and neck, tongue, palate, nasal cavity, larynx, pharynx, trachea, thyroid gland, esophagus. **[b] Inferior deep cervical nodes:** lie on the internal jugular vein near the subclavian vein. Receive afferent lymphatics from the anterior jugular, transverse cervical and apical axillary nodes.

31. Thoracic lymph nodes, lymph nodes of upper limb

THORACIC duct begins in the abdomen at the cisterna chyli.

[a] Sternal or parasternal (internal thoracic) nodes: are placed along the internal thoracic artery. Receive lymph from medial portion of breast, intercostal spaces, diaphragm, supraumbilical region of abdominal wall. Drain into the junction of internal jugular and subclavian veins. **[b] Intercostal nodes:** lie near the heads of the ribs. Receive lymph from the intercostal spaces and pleura. Drain into the cisterna chyli/thoracic duct. **[c] Phrenic nodes:** lie on the thoracic surface of the diaphragm. Receive lymph from the pericardium, diaphragm and liver. Drain into the sternal and posterior mediastinal nodes.

UPPER LIMB:

[a] Lymphatics of the finger: drains into the plexus on the dorsum and palm of hand. **[b] medial group of lymphatic vessels:** accompanies the basilica vein. Drains into lateral axillary nodes, then central axillary nodes and then apical axillary nodes. **[c] Lateral group of lymphatic vessels:** accompanies the cephalic vein. Drains into lateral axillary nodes, into deltopectoral node and then into apical nodes. **[d] Axillary lymph nodes:** **CENTRAL NODES** (near the base of the axilla between lateral thoracic and subscapular veins. Receives lymph from lateral pectoral and posterior groups of nodes → drains into apical nodes). **LATERAL/ BRACHIAL NODES** (posteromedial to the axillary veins. Receive lymph from upper limb → drain into central nodes). **SUBSCAPULAR/ POSTERIOR NODES** (along the subscapular vein. Receive lymph from posterior thoracic wall and posterior aspect of shoulder → drain into central nodes). **PECTORAL/ ANTERIOR NODES** (along the inferolateral border of pectoralis minor. Receive lymph from anterior and lateral thoracic walls → drains into central nodes). **APICAL NODES** (the apex of axilla medial to the axillary

vein and above the upper border of pectoralis minor. Receives lymph from all of the other axillary nodes and drain into subclavian trunks).

32. Abdominal lymph nodes, pelvic lymph nodes, lymph nodes of lower limb

Anterior abdominal wall: [a] Lymphatic in the region above the umbilicus → drain into the axillary lymph nodes. [b] Lymphatic in the region below the umbilicus → drain into the superficial inguinal nodes. [c] Superficial inguinal lymph nodes. Receives lymph from lower abdominal wall, buttocks, penis, scrotum, labium major and lower parts of vagina and anal canal → drain into external iliac nodes, ultimately and lumbar (aortic) nodes.

Pelvic lymph nodes: follow the internal iliac vessels to the internal iliac nodes, to the common iliac nodes and then to aortic nodes. Drains lymph from the rectum along superior rectal vessels, inferior mesenteric nodes and aortic nodes. Lymph vessels from ovary, uterine tube and fundus follow ovarian artery → drain into paraaortic nodes. Lymph vessels from uterine body and cervix and bladder → drain into internal iliac nodes. Lymph vessels from prostate and rectum → drain into internal iliac nodes.

Lymph of lower limb: [a] superficial lymph vessels formed by vessels from gluteal region, abdominal wall and external genitalia. Divided into medial group which follows the great saphenous vein in the inguinal nodes and into lateral group follows the small saphenous vein to the end in the popliteal nodes and inguinal nodes. [b] Deep lymph vessels that consists of anterior and posterior tibial peroneal vessels and enter the popliteal lymph nodes. Drain into lumbar (aortic) nodes and vessels. [c] Superficial inguinal group lymph nodes located subcutaneously near the saphenous femoral junction and drains the superficial thigh region → drains into external iliac nodes. [d] Deep inguinal group of lymph nodes lies deep to the fascia lata in the medial site of the femoral vein. → Drains into external iliac nodes through femoral canal.

33. Thyroid gland, parathyroid gland

Thyroid gland: an endocrine gland that produces thyroxine and thyrocalcitonin (are essential for the metabolism and growth). Thyroid takes place from food to produce hormones. Consists of right and left lobes connected by isthmus, which crosses the 2nd and 3rd tracheal rings. Pyramidal lobe extends upward from the isthmus. Supplied by superior and inferior thyroid arteries and sometimes the thyroid ima a. Drains via the superior and middle thyroid veins to the internal jugular vein and via the inferior thyroid vein to brachiocephalic vein.

Parathyroid gland: are two superior and two inferior small endocrine glands which secrete parathyroid hormone for calcium metabolism – essential for life because low calcium levels lead to lethal neuromuscular disorders. The four ovoid bodies lie against the dorsum of the thyroid under its sheath. Supplied chiefly by inferior thyroid artery.

34. Suprarenal glands, paraganglia

Suprarenal (adrenal) gland: a retroperitoneal organ lying the superomedial aspect of the kidney. Surrounded by a capsule and renal fascia. Is pyramidal on the right and semilunar on the left produces 3 types of steroid hormones. Produce mineralcorticoids (aldosterone – controls electrolyte), glucocorticoids (cortisol – glucose regulation, immune system), androgens (sexual development). Has a medulla that is derived from embryogenic neural crest cells. Receives preganglionic sympathetic nerve fibers and secretes epinephrine and norepinephrine. Receives arteries from 3 sources (superior suprarenal artery, middle and inferior suprarenal artery). Is drained via the suprarenal vein, which empties into the inferior vena cava on the right and the renal vein on the left.

Paraganglia: are small groups of chromophil cells connected with the ganglia of the sympathetic trunk and the ganglia of the celiac, renal, suprarenal, aortic and hypogastric plexuses. Connected near the suprarenal glands and essentially function the same way as the suprarenal medulla. Sometimes are found in connection with the ganglia of other sympathetic plexuses.

35. Diffuse endocrine system

Consist of cells from the CNS, PNS and nearly all organs with the common phenotype – the ability to produce biological active amines or peptides which act like neurotransmitters, hormones, paracrine regulators. Endocrine system is a series of ductless or endocrine glands that secrete hormones into the blood circulation and are carried to body cells. Controls and integrates the functions of other organ systems – reproduction, growth and metabolism. Pituitary pineal, thyroid, parathyroid, suprarenal glands. Pancreas, thymus, gonads, hypothalamus, kidneys, liver, stomach. Includes tropic hormones that control variety of physiologic responses and regulate functional states of other endocrine glands.

36. Pituitary gland

Also called hypophysis, is an endocrine gland about 0.5g in humans. It's a protrusion of the button of the hypothalamus at the base of the brain. Rests in a small bony cavity (sella turcica) covered by a dural fold (diaphragmatic sellae). Connected to hypothalamus by the median eminence. Sits in pituitary fossa. Secretes 6 hormones that regulate homeostasis. Consists of two components (anterior pituitary or adenohypophysis and posterior pituitary or neurohypophysis). Anterior pituitary gland receives its signals from the parvocellular neurons. Posterior pituitary receives its signals from magnocellular neurons. Anterior pituitary synthesizes and secretes ACTH, TSH, growth hormones prolactin, FSH, MSH, BSH. Posterior pituitary stores and release oxytocin and antidiuretic hormone (ADH, AVP). Help for growth, blood pressure, energy, water, breast milk, sex organs.

37. Thymus

Is a lymphoid organ. Is the site at which immature lymphocytes develop into T – lymphocytes (immune system). Secretes thymic hormones which cause T – lymphocytes to gain immunocompetence. It begins involution after puberty. Located anatomically in the anterior superior mediastinum in the front of the heart and behind the sternum. Its very small and enlarges during childhood. Contains capsule, thymic corpuscles, cortex, Medulla, Interlobular septum, thymic lobule. Composed of two identical lobes and numerous lobules which are connected by anterior areolar tissue. The most important role is the induction of central tolerance (develop T cells and B cells).

Central Nervous System

1. Nervous system – general anatomy: Nervous system can be separated into parts based on structure and on function:

Structurally: a) CNS – b) Peripheral & nervous system

Functionally: a) somatic – b) visceral part

CNS composed of Brain and Spinal cord (develop from neural tube in embryo)

PNS composed of all nervous structures outside the CNS that connect CNS to the body, develop from neural crest cells and as outgrowths of CNS.. Consist of Spinal nerves, cranial nerves, visceral nerves+ plexuses, enteric system

Brain → cerebral hemispheres, cerebellum, brainstem

Hemispheres: outer portion/ gray matter, inner portion → white matter, ventricles

Cerebellum → two lateral lobes and a midline portion

Brainstem → diencephalon (thalamus – hypothalamus), midbrain/mesencephalon, pons + medulla

Spinal cord is the major reflex center + conduction pathway between body and brain

Enteric system → motor neurons – sensory neurons

Plexuses → submucous nerve plexus, myenteric .. plexuses formed by ganglia and bundles of nerve fibers which pass between ganglia and from ganglia into surrounding tissues

Neurons in enteric system derived from neural & crest cells associated with occipitocervical + sacral regions

Functional subdivisions: somatic part: consists of nerves that carry sensations from peripheral regions to CNS, nerves that innervate voluntary muscles.

Somatic nerves arise segmentally along CNS in association with somites which are arranged segmentally along neural tube. Part of each somite gives rise to skeletal muscle + dermis.

Visceral part: motor + sensory components. Visceral motor component is commonly referred to autonomic division of PNS (sympathetic- parasympathetic parts). Visceral sensory neurons arise from neural crest cells + send processes (medally into adjacent neural tube, laterally into regions for developing body)

2. Spinal cord: spinal cord is the major reflex centre + conduction pathway between body + brain.

It is located in the vertebral canal and it is protected by: a) the vertebrae and their associated ligaments + muscles. B) spinal meninges, c) cerebrospinal fluid

It is a continuation of medulla oblongata and extends from foramen magnum to L2 vertebral level. It has two spindle-shaped swellings: in the neck region(cervical enlargement), - lumbar region(lumbar enlargement)

At lower end spinal cord tapers into medullary cone and ends as a thin thread, the terminal filament, Anterior median fissure at ventral side and posterior median sulcus at dorsal side mark the boundaries between 2 symmetrical halves of spinal cord.

Nerve fibers enter dorsolaterally and emerge ventrolaterally at both sides of spinal cord → unite to form posterior/dorsal roots and anterior/ventral roots.

The roots join to form the spinal nerves. 31 pairs of spinal nerves which emerge through intervertebral foramen from vertebral canal. 8 pairs cervical nerves, 12 pairs thoracic, 5 pairs lumbar, 5 pairs sacral, 1 coccygeal nerves

Structure: gray matter/ substantia grisea appears as a butterfly surrounded by white matter/substantia alba

We distinguish a dorsal/posterior horn and ventral anterior horn

Anterior horn → motoneurons supplying voluntary muscles, neuromuscular spindles. Motoneurons grouped into columns → medial group(innervations of muscles of trunk – lateral group(innervations of muscles of limbs

Lateral horn....

Posterior horn → cells belong to connector cells. Are grouped into nucleus proprius in the head, nucleus thoracicus c8-l3

Sulci subdivide white matter into: dorsal column/ posterior funiculus – lateral column/ lateral funiculus – ventral column/ anterior funiculus

White commissure connects the two halves of spinal cord

Reflex arcs: afferent fibers of posterior root which originate from ganglion transmit signals to posterior horn and then to brain

Monosynaptic intrinsic reflex (stretch reflex) – multisynaptic extrinsic reflex (withdrawal reflex)

Cross sections of spinal cord: in cervical and lumbar enlargements cross sectional area is larger. Largest in C4-C5, L4-L5 .. In both swellings nerves that supply extremities cause increase in gray matter.

White matter extensive in cervical region and diminishes .. Ascending sensory tracts: increase in number from sacral to cervical .. Descending motor tracts decrease from cervical to sacral

Gray matter and posterolateral tract change shape through level

Syndromes: complete transection (paralysis – sensation loss), Hemisection, central injury, anterior cord syndrome, posterior cord syndrome, cauda equina lesion (loss of sensation)

3. Medulla oblongata, pons

Medulla oblongata the most caudal part of brainstem,

Ends at foramen magnum of the uppermost rootlets of the first cervical nerve, it lies in the posterior cranial fossa.

Cranial nerves 6-12 are attached

Cavity of medulla forms inferior part of 4th ventricle

Two parts: open and closed . The medulla is thought of as being in 2 parts: 1) open or superior part where dorsal surface is formed by 4th ventricle, 2) closed or inferior part

Medulla is cone shaped and becomes continuous with the spinal cord at the foramen magnum . located right behind the basilar part of occipital bone. Dorsal aspect faces backwards. Back of the upper part of medulla forms floor of 4th ventricle. Forms roof of inferior part of ventricle together with inferior velum

Attachment of cerebellum → superior – middle – inferior

Ventral side marked with olive – pyramids

Emerging from ventrolateral side are the filaments of 4 lowest cranial nerves: hypoglossal, accessory, vagus, glossopharyngeal.

Anterior surface: sulci- funiculi of spinal cord are continuous in medulla

Dorsal distinct/ lower half: posterior median sulcus

Pons : above medulla . on each side pons becomes continuous with middle cerebellar pedicle . groove between pons and medulla: bulbopontine sulcus arise → vestibulocochlear , facial , abducent (6,7 cranial nerves)

Trigeminal emerges from upper part of pons, lies in anterior part of posterior cranial fossa, . Cavity in pons forms superior part of 4th ventricle, Besides reticular formation and cranial nerves pons contain pontine nuclei scattered in ventral part.

Ventral surface: this surface is marked by basilar sulcus which is occupied by basilar artery.

Lateral surface: pons narrows to form middle cerebellar peduncles, terminating in cerebellum → trigeminal nerve emerges

Dorsal surface: upper floor of 4th ventricle

Gray matter: internal structure of oblongata and pons (besides nuclei of CN)

White substance composed of Ascending and Descending tracts

4. Rhomboid fossa

Anterior part of 4th ventricle is named rhomboid fossa and its formed by dorsal surface of pons and medulla oblongata. The opened upper half of oblongata its anterior wall constitutes floor of 4th ventricle . Covered by thin layer of gray substance continuous with that of medulla spinalis/ spinal cord. Superficial to this is a thin lamina of neuroglia/ glial cells

Marked by: median sulcus, limitans sulci, medial eminence

Fossa consist of 3 parts: superior part, intermediate and inferior part.

In superior part of fossa it corresponds with lateral limit and forms locus caeruleus

At level of colliculus facialis the sulcus limitans widens into superior fovea and in inferior part of fossa appears as a distinct dimple the inferior fovea.

Lateral to fovea is a rounded elevation called area acustica

5. Mesencephalon(midbrain)

The mesencephalon is the first part of the brainstem . consist of tegmentum as all three parts of brainstem. At medulla + pons it is overlain by cerebellum and in midbrain by tectum..

Ventral part of brainstem contains descending tracts that form: pyramids, pontine bulb , cerebral peduncles.

Dorsal surface: upper part of roof of 4th ventricle, superior cerebellum peduncles, inferior and superior colliculi, in the midline pineal body, trochlear nerve emerge below inferior colliculi

Midbrain spreads out into cerebral peduncles which connect brainstem to cerebrum, on the outside of peduncles are medial and lateral geniculate body → give rise to optic tract. The 2 optic tracts meet in optic chiasm and the optic nerve merge. Between peduncles the oculomotor emerges.

Ventral part → crura cerebri, emerge from hemispheres and enter pons --- cerebral peduncles.

Internal structure/ crura cerebri.. crura cerebri consists of white matter-fibers descending from cortex.

Internal structure/ tegmentum:

Gray matter. Nucleus of oculomotor nerve . interstitial nucleus, nucleus of trochlear nerve, mesencephalic part of trigeminal nucleus, reticular formation , red nucleus (important part of extrapyramidal system) , substantia nigra

White matter: medial lemniscus, trigeminal lemniscus, lateral lemniscus, spinal lemniscus, tectospinal+tectobulbar tracts, spinotectal tract, tracts to and from cerebellum , medial longitudinal fasciculus

Internal structure/ tectum (contains visual and auditory reflex centers)

Superior colliculi , contained gray matter is visual reflex center.

Receives afferents from → retina and visual cortex, spinal cord, inferior colliculi .. send efferents to oblongata , cord

Inferior colliculi , gray matter is auditory reflex center,

Afferents → lateral lemniscus

Efferents → superior colliculi, spinal cord, nuclei of cerebral nerves

Preectal nucleus: lies cranial to superior colliculi, center for light reflex, receives afferents from optic tract, efferents to Edinger – Westphal nucleus

6. Thalamus(dorsal thalamus)

Diencephalon is central core of cerebrum. Consists 3rd ventricle, structures that form boundaries

Inferior surface: area exposed to intact brain. Formed by hypothalamic and other structures which include, optic chiasm, optic tracts, infundibulum, mammillary bodies

Superior surface: superior wall formed by roof of 3rd ventricle

Lateral surface: bounded by internal capsule of white matter and consists of fibers that connect cortex with brainstem and cord

Medial surface: formed by medial surface of thalamus and its inferior part by hypothalamus, these two parts separated by hypothalamic sulcus.

Thalamus is large ovoid nuclear complex that forms major part of diencephalon. It is region of great functional importance. Thalamic nuclei are the relay stations for most sensory pathways. They extend from interventricular foramen to the quadrigeminal plate of midbrain.

Anterior end: narrow and rounded forms posterior boundary of interventricular foramen.

Posterior end: expanded to form pulvinar

Superior surface: forms floor of lateral ventricle.

Inferior surface: continuous with tegmentum

Medial surface: forms superior part of lateral wall of 3rd ventricle

Lateral surface: separated from nucleus by band of white matter called internal capsule

Thalamus connected to cerebral cortex by corona radiata or thalamic radiation

The most prominent bundles of fibers are → anterior thalamic radiata, superior thalamic radiata, posterior – inferior thalamic radiata ..

Based on fiber connections, two types of thalamic nuclei exist specific thalamic: connections to cortex, nonspecific connections to brainstem but not to cortex

Specific thalamic nuclei subdivided into following nuclear groups → anterior thalamic nuclei, medial thalamic nuclei, ventrolateral thalamic nuclei, lateral geniculate nucleus, medial geniculate nucleus, pulvinar, reticular nucleus of thalamus,

Nuclear groups separated by layers of fibers: external medullary lamina: covers thalamus on lateral surface. Internal: ventricular sheet of white matter that divides gray matter into medial and lateral halves.

Thalamus covered on superior surface by stratum zonale.

Nonspecific thalamic nuclei: median nuclei, intralaminar nuclei

Alternative subdivision: lateropolar nucleus, dorso-oral, dorso-intermediate, dorsocaudal, ventro-oral, ventrointermediate, ventrocaudal

7. Hypothalamus

Forms floor of diencephalon

Extends from region of optic chiasma to caudal border of mammillary bodies

Lies below hypothalamic sulcus

Placed close to limbic system, thalamus, hypophysis, ascending and descending tracts

Hypothalamus is related with optic chiasma, tuber cinereum and infundibulum, mammillary bodies

Poorly myelinated hypothalamus → includes preoptic region

Richly myelinated hypothalamus the mammillary body forms the caudal segment of hypothalamus

Medial zone of nuclei: preoptic nucleus, anterior nucleus, supra-chiasmatic, paraventricular oxytocin, dorsomedial, ventromedial, infundibular, posterior nucleus

Lateral zone: preoptic nucleus, supraoptic nucleus, supra-chiasmatic, lateral tuberal, tuberomammillary limbic system

Hypothalamus and hypophysis

Hypophysis: adenohypophysis, neurohypophysis

Adenohypophysis: endocrine gland

Neurohypophysis: composed of nerve fibers, capillary, and unique type of glia, the pituicytes.

Hypophysis, proximal part, distal part

Connections of hypothalamus and hypophysis cerebri → hypothalamohypophyseal tract, hypophyseal portal system.

Connections of hypothalamus: afferent – somatic visceral → through tractus solitarius and reticular formation

efferent descending fibers to brainstem and cord.

8. Subthalamus, epithalamus, metathalamus,

Metathalamus composite structure of thalamus,

consist of 1) lateral geniculate nucleus, processing center for visual information, connected with visual cortex.. 2) medial geniculate nucleus, represents thalamic relay between inferior colliculus and auditory cortex, responsible for direction and maintenance of attention

subthalamus: lies inferior to thalamus between thalamus and tegmentum of midbrain.

Zona incerta between forel's field h1 and h2 is relay station for descending fibers of globus pallidus.

Globus pallidus is divided into lateral segment , medial inner. Segments connected by fibers to one another and to putamen and caudate nucleus.

Subthalamic nucleus between h2 and internal capsule has close connection to pallidum

Lenticular fasciculus emerges at dorsal margin of inner segment and forms h2.

Afferents from → cortex, basal nuclei, thalamus

Efferent to → red nucleus, reticular formation, hypothalamus

Epithalamus: habenulla, pineal gland, epithalamic commissure,

Habenulla: afferents reach nuclei via medullary stria of thalamus

Contains fibers from septal nuclei, anterior perforated substance, preoptic region

Receives fibers from amygdaloid body .

Efferents → habenulotectal tract, habenulotegmental, habenulointer-peduncular tract

Pineal gland: small conical structure attached by pineal to diencephalon, lies posterior to midbrain. .. superior part of base contains habenular commissure

9. Telencephalon

Sulcu and gyri main cortical areas

Cerebrum → cerebral hemispheres, basal ganglia

Cerebral hemispheres separated by cerebral falx within the longitudinal cerebral fissure.

Each hemisphere divided into 4 lobes. Frontal-parietal-temporal-occipital

Superior view: central coronal sulcus separates frontal from parietal lobes,

Lateral view: these lobes lie superior to transverse lateral sulcus and the temporal lobe inferior to it
Occipital separated by parietal and temporal by parieto-occipital sulcus

Anterior most points: frontal and temporal lobes

Posterior most: occipital pole

Hemispheres connected by corpus callosum

Frontal lobe → superior frontal gyrus, middle frontal gyrus, inferior frontal gyrus

Temporal lobe → superior temporal gyrus, middle temporal gyrus, inferior temporal gyrus

Central sulcus → convolution above, convolution below

Boundary between parietal and temporal = angular gyrus

Dorsally to splenium → cingulate gyrus

Ventrally → parahippocampal gyrus

Frontal lobe → motor area: occupies precentral gyrus(primary), premotor area(secondary)..

Parietal lobe: primary somesthetic area, secondary somesthetic area

Occipital lobe → primary visual area, secondary visual area

Temporal lobe → primary auditory area, secondary auditory area, wernicke's area.

Other areas: taste area, vestibular area, insula area

10. nerve fascicles of cerebrum

White matter of hemispheres composed of myelinated fibers of different diameters supported by neuroglia

According to their connections → commissural, association fibers, projection

Commissural connect corresponding regions of 2 hemispheres

Corpus callosum → largest commissure connecting the hemisphere. Lies at the bottom of longitudinal fissure

Divided: rostrum, genu, trunk/body, tapetum, splenium

Anterior commissure: small bundle of nerve fibers that crosses in midline in lamina terminalis.

Posterior commissure: bundle of fibers that crosses midline above the opening of cerebral aqueduct

Fornix : composed of myelinated fibers and is the efferent system of hippocampus

Habenular commissure: crosses midline in superior part of root of pineal stalk .

Projection fibers: afferents and efferents must travel between gray matter within hemisphere.

Association fibers: connect cortical regions within hemisphere. Short association and long association

11. Basal nuclei

Basal nuclei= masses of gray matter → corpus striatum, amygdaloid nucleus, claustrum

Basal nuclei → role in control of posture and voluntary movement.

Control muscular movements by influencing cortex.

Amygdaloid nucleus: situated in temporal lobe close to uncus. Part of limbic system

Through its connection it can affect response to environment.

Amygdaloid body → cortical nucleus, central, basal nucleus, lateral

Electrical stimulation of amygdale induces autonomic and emotional responses.

Clastrum = thin sheet of gray matter that is separated from lateral surface of lentiform nucleus by external capsule.

Lateral is subcortical white matter of insula

Corpus striatum: lateral to thalamus ... divided by internal capsule (caudate nucleus- lentiform nucleus)

Caudate → head, body, tail

Lentiform: base directed laterally and blade medially. Buried in white matter of hemisphere. Divided by lateral medullary lamina (putamen – globus pallidus)

Afferents → corticostriate, thalamostriate, nigrostriate, brainstem

Efferents → striatopallidal, striatonigral

Substantia nigra+ subthalamic nuclei

Closely related to basal nuclei, neurons of nigra → dopaminergic and inhibitory , connections to corpus striatum

Neurons of nuclei → glutaminergic and excitatory . connections to globus pallidus and nigra

12. Ascending spinal tracts

Tracts of anterolateral funiculus..

lateral spinothalamic tract : for pain
afferent poorly myelinated posterior root fibers(1st neuron)
subdivided into sacral – lumbar- thoracic – cervical fibers

anterior spinothalamic tract: crude touch
afferent fibers(1st neuron)
anterior and lateral protopathic sensibility
spinotectal tract: pain fibers to roof of midbrain

pathways of posterior funiculus : fasciculus gracilis and cuneatus : transmit exteroceptive and proprioceptive impulses of epicritic sensibility

short ascending collaterals branch from ascending fibers. They terminate at posterior horn cells forming bundles.

Cerebellar pathways of lateral funiculus: muscle joint sense to cerebellum

Posterior spinocerebellar tract

Anterior spinocerebellar tract

Other sensory pathways: spinoreticular-spinolivary – visceral sensory tracts

13. Descending spinal tracts

Motor neurons are situated in anterior gray columns and send axons to innervate skeletal muscle through anterior roots. They are called lower motor neurons. Descending pathway made up of 3 neurons, 1st: cell body in cortex, 2nd an internuncial neuron, the axon of 1st neuron synapses. 3rd: synapses with 2nd at anterior gray column.

Corticospinal tract, pyramidal tract.

Fibers originate mostly from precentral gyrus or from cortical regions of parietal lobe

Most fibers terminate in cervical cord to supply upper limb

Rest terminate in lumbar spinal cord to supply lower limb

Extrapyramidal tracts: systems from brainstem that influence motor system

14. Nuclei of cranial nerves- nuclei of origin –nuclei of termination

Spinal cord → anterior horn : origin of motor fibers , posterior horn: termination of sensory fibers

Medulla oblongata: nuclei of origin: with cell bodies of efferents, nuclei of termination: for axon terminals of afferents

Somatomotor nuclei: close to midline

Visceromotor nuclei: follows laterally, → genuine visceromotor, belong to parasympathetic NS, originally visceromotor: of transformed branchial and arch muscles

Parasympathetic nuclei: dorsal nucleus of vagus nerve, inferior salivatory nucleus, superior salivatory nucleus, edinger – westphal nucleus/ accessory nucleus of oculomotor nerve .

Motor nuclei of branchial arch nerves → caudally, spinal nucleus of accessory nerve which extends into cervical cord, series continues cranially with ambiguous nucleus .. nucleus of facial nerves → lies deep, its fibers run around abducens nucleus. . most cranial nucleus is motor nucleus of trigeminal nerve

Sensory nuclei are located laterally: medially is solitary nucleus, nucleus of trigeminal nerve, .. most laterally vestibular nucleus, cochlear nucleus

15. Auditory pathway

Cochlear nuclei: fibers from radix cochlearis enter medulla at level of anterior cochlear nucleus and bifurcate

Ascending branches extend to posterior cochlear nucleus

Descending branches extend to anterior cochlear nucleus

Fibers from basal cochlear convolutions terminate in dorsomedial nuclei

Fibers of uppermost cochlear convolutions terminate in ventrolateral nuclei

Secondary fibers originate from neurons of cochlear nuclei.

Fiber bundles from anterior cochlear nucleus cross to opposite side as the trapezoid body and then ascend as the lateral lemniscus to inferior colliculus.

Fibers from posterior cochlear nucleus cross as posterior acoustic striae

Few fibers of lemniscus are relayed to tertiary fibers in (superior olive) posterior nucleus of trapezoid body, anterior nucleus of trapezoid body, nuclei of lateral lemniscus

Medial nucleus of superior olive receives fibers from cochlear, nuclei of both sides and is interposed in a system serving directional hearing,

from posterior nucleus of lateral lemniscus, fibers cross to contralateral lemniscus

inferior colliculus

lateral lemniscus predominantly terminates in principal nucleus of inferior colliculus

inferior colliculi interconnected by commissure of inferior colliculi

Medial geniculate body → next section of auditory pathway is the peduncle of inferior colliculi which extends as a strong fiber tract from colliculus to medial geniculate body

Relay station of acoustic system. Acoustic radiation originates from there,

Two geniculate bodies connected with inferior supraoptic commissure

Acoustic radiation: fibers run from medial geniculate body transversely through inferior posterior part of internal capsule and ascend ventrally in temporal lobe to auditory cortex

Within radiation fibers undergo rotation

3 regions of hearing → primary auditory, secondary auditory, posterior ectosylvian gyrus

16. Vestibular pathway

Vestibular nuclei → fibers of radix vestibularis, enter medulla oblongata at level of the lateral vestibular nucleus and bifurcate into ascending – descending branches that terminate in superior, medial, inferior vestibular nucleus

Fibers for different labyrinth parts extend to specific regions of nuclear complex.

Fiber bundles for → macula of saccule, macula of utricle, ampullary crests

Groups of neurons respond to linear or rotational acceleration, ipsilateral or contralateral rotation

Vestibular complexes connected by commissural fibers

Secondary vestibular pathways, connections to cord, vestibular formation, cerebellum, oculomotor nuclei

Vestibulospinal tract originates from lateral vestibular nucleus and reaches into sacral spinal cord

Fibers terminate at spinal interneurons → motoneurons activated of extensor nucleus

Fibers from all nuclei extend to reticular formation

17. Reticular Formation

Reticular formation resembles a net made up of nerve cells and fibers

Extends from spinal cord to cerebrum

Placed among important nerve tracts and nuclei

Efferents influence nerve cells at all levels of CNS

Afferent from most sensory system

It can influence → skeletal muscle activity, somatic and visceral sensations, autonomic and endocrine systems, level of consciousness

Diffuse network can be divided into 3 lateral longitudinal columns of nerve cells

Median column: intermediate size neurons, from medulla to midbrain

Medial column: large neurons/lateral to median column

Lateral column: small neurons/ between medial column and sensory trigeminal nucleus

Efferents → reticulospinal : from medulla and pons to cord

Afferents → sensory spinoreticular fibers terminate in medial field of medulla and pons

Effect on motor system: differential effect on spinal motor system, in medial field of medulla lies an inhibitory center

Respiratory and CNS control centers → neurons regulate respiration. Neurons for inspiration localized in central field of medulla, expiration localized dorsal and lateral ..

18. Third ventricle

Ventricles are 4 fluid filled cavities within brain, 2 lateral, 3rd and 4th ventricles.

Lateral and 3rd communicate through interventricular foramen

3rd and 4th by narrow cerebral aqueduct

4th is continuous with narrow central canal of spinal cord and with subarachnoid space through 3 foramina in its roof.

Central canal has small dilatation at end → terminal ventricle

Ventricles are lined with ependyma and filled with CSF

3rd ventricle: slitlike cleft between the two thalami

Anterior wall → lamina terminalis, fornix, anterior commissure

Superior wall → tela choroidea, choroid plexus

Lateral wall → thalamus, hypothalamus, hypothalamic sulcus, striae medullaris thalami, interthalamic connections

Posterior wall → posterior commissure, pineal recess, suprapineal recess, habenular commissure

Interior wall → optic chiasma, tuber cinereum, infundibulum

19. Lateral ventricles

2 large ventricles, one in each hemisphere

Ventricle is a roughly

Body of ventricle: central part parietal lobe, extends from interventricular foramen posteriorly as far as posterior end of thalamus where it becomes continuous with posterior and inferior horns

Roof: undersurface of corpus callosum

Medial wall: septum pellucidum, tela choroidea

Lateral wall: body of caudate nucleus

Anterior horn: extends forward into frontal lobe, continuous posteriorly with body at the interventricular foramen

Roof: undersurface of corpus callosum

Anterior wall: genu of corpus callosum

Lateral wall: caudate nucleus

Medial wall: septum pellucidum, fornix

Floor: caudate nucleus, corpus callosum rostrum

Posterior horn: roof/lateral wall: corpus callosum and apex, medial wall, floor: collateral eminence

Inferior horn: roof/lateral wall, medial wall, floor

20. Meninges

Brain is surrounded by mesodermal coverings the meninges

Outer layer is the tough pachymeninx dura matter

Inner layer is the soft leptomeninx, consist of arachnoid matter, pia matter

Dura matter: lines inner surface of skull and forms periosteum, sturdy septa extend from it deep into cranial cavity

A sickle shaped fold of dura the falx of the cerebrum suspends ventrically between the hemispheres

Arachnoid mater: adjoins closely the inner surface of dura mater and is separated from it by capillary cleft, the subdural space, it encloses subarachnoid space which contains CSF and is connected with pia mater by trabeculae and septa that form a meshwork and a system of communicating chambers.

Pia mater: meningeal covering that contains the blood vessels, borders directly on brain and forms pia glia barrier, from here vessels enter brain, surrounded by pia for some distance

21. Cerebellum :

Cerebellum: regulation of muscle tone, coordination and fine tuning of movement,

Develops from alar plate of brain stem and forms the roof of 4th ventricle

Superior surface is covered by the cerebrum, embedded into inferior surface is medulla.

Unpaired central part → vermis, hemispheres cerebral

Phylogenetically cerebellum consists of old and new portions, subdivided: flocculonodular lobe, cerebellar body

Anterior lobe of cerebellar body → anterior lobe and other vermis sections

Receives spinocerebellar tracts.

Traditional nomenclature. According to it most sections of vermis are associated with a pair of hemispheric lobes: central lobule, culmen, declivity, folium, tuber, pyramid, urulla, nodulus

Nuclei: located deep in the white matter.

Cerebellar peduncles: efferent and afferent pathways run through.

Cerebellar cortex (gray matter). Lies below surface and follows course of sulci and folia.

Regularly structured throughout all cerebellar regions,

Consist of three layers: molecular layer, Purkinje cell layer, granular layer

White matter of cerebellum,

Fibra propriae, projection fibers

Afferents: vestibulocerebellar, spinocerebellar, bulbocerebellar etc..

Efferents: cerebellar-thalamic, cerebellar-brainstem, cerebellar-vestibular, cerebellar-vestibular

22. Visual pathway

Visual pathway consists of 4 neurons

1st photoreceptors

2nd bipolar neurons

3rd large ganglion cells of retina

4th geniculate cells

Optic nerve enters cranial cavity through optic canal

At the base of diencephalon forms optic chiasm with other optic nerve. Fiber bundle starting from chiasm is the optic tract. The two tracts run around peduncles to the lateral geniculate bodies

Before reaching each tract divides into lateral and medial root

Medial fibers continue to superior colliculi

Optic radiation begins at lateral geniculate body

In striate area of right hemisphere terminate fibers for right halves of retinae

Right hand and visual field are represented in left hemisphere which is dominant

23. Gustatory pathway

Taste buds/ gustatory receptors

Register different taste sensations

Taste buds and olfactory epithelium → chemoreceptoris

Found in largenumber in lateral walls of vallate papillae,

Found in moderate numbers in fungi form and foliate papillae

Found isolated in soft palate, pharyngeal wall, epiglottis

Consist of modified epithelial cells

Small opening at epithelial surface, the taste pore into which sensory cells send processes

Sensory cells generated from epithelial cells at base of bud.

Base innervated by thin myelinated nerve fibers that branch and supply adjacent epithelium

Taste buds contain 3 cell types: clear taste cells, small basal cells, dark supporting cells

Taste sensation: sour – lateral margins, salty – tip and margins, bitter - base, sweet - tip

Taste fibers: assigned to three cranial nerves (facial, glossopharyngeal, vagus)

Originate from pseudounipolar neurons in cranial nerve ganglia (trigeminal ganglion, petrosal ganglion, nodose ganglion)

Primary taste fibers terminate in solitary nuclear complex

Secondary taste fibers originate from solitary nuclear complex

24. Olfactory pathway

Olfactory epithelium occupies small region in both nasal cavities → olfactory region

Multilayered sensory epithelium composed of supporting cells, receptor cells with deep-lying nuclei

Olfactory region also contain mucous glands

Apical part of sensory cell tapers into thin shaft that slightly extends surface of epithelium

At basal end ovoid cell body forms processes.

Apart from olfactory nerves terminal nerve, vomeronasal nerve

Terminal: enters below anterior commissure into brain, its regarded as an autonomic nerve

Vomeronasal: from vomeronasal organ to accessory olfactory bulb

25. Limbic system

Phylogenetically old parts of telencephalon together with its border zones and connections to subcortical centers are known as the limbic system

Subdivision: the cortical region of limbic system form a c shaped complex on medial aspect of hemisphere that consists of (outer arch →) parahippocampal gyrus, cingulate gyrus, subcallosal area.. system → inner arch, outer arch

Pathways: limbic system influence hypothalamus via 3 pathways: fornix, terminal stria, ventral amygdalofugal fibers

Connection to tegmental nuclei of midbrain is established through descending bundle of habenular nucleus

Within limbic system runs a multiple pathway the neuronal circuit of papez

Hippocampal formation: hippocampus is central structure of limbic system, .. dentate gyrus lies between fimbria of hippocampus and parahippocampal gyrus .. parahippocampal gyrus between hippocampal fissure and collateral sulcus.

1. General anatomy of bone

Bones: Are calcified connective tissue consisting of cells (**osteocytes**) in a matrix of ground substance and collagen fibers. Serve as a **reservoir** for **calcium** and **phosphorus** and act as **levers** on which muscles act to produce the movements permitted by joints.

Contain internal soft tissue, the **marrow**, where blood cells are formed. Are classified, according to shape, into long, short, flat, irregular, and sesamoid bones; and according to their developmental history into endochondral and membranous bones.

A. Long bones → Include the humerus, radius, ulna, femur, tibia, fibula, metacarpals, and phalanges. Develop by replacement of hyaline cartilage plate (**endochondral ossification**). Have a shaft (**diaphysis**) and two ends (**epiphyses**). The **metaphysis** is a part of the diaphysis adjacent to the epiphyses.

1. Diaphysis → Forms the **shaft** (central region) and is composed of a thick tube of **compact bone** that encloses the **marrow cavity**.

2. Metaphysis → Is a part of the diaphysis, the growth zone between the diaphysis and epiphysis during bone development.

3. Epiphyses → Are **expanded articular ends**, separated from the shaft by the epiphyseal plate during bone growth, and composed of a **spongy bone** surrounded by a thin layer of compact bone.

B. Short bones → Include the carpal and tarsal bones and are approximately cuboid shaped. Are composed of **spongy bone** and **marrow** surrounded by a thin outer layer of **compact bone**.

C. Flat bones → Include the ribs, sternum, scapulae, and bones in the vault of the skull. Consist of **two layers** of **compact bone** enclosing **spongy bone** and **marrow space**. Have articular surfaces that are covered with fibrocartilage. Grow by replacement of connective tissue.

D. Irregular bones → Include bones of mixed shapes such as bones of the skull, vertebrae, and coxa. Contain mostly **spongy bone** enveloped by a thin outer layer of **compact bone**.

E. Sesamoid bones → **Develop in certain tendons** and reduce friction on the tendon, thus protecting it from excessive wear.

Are commonly found where tendons cross the ends of long bones in the limbs, as in the wrist and the knee (i.e., patella)

Epiphyseal plate (growth plate) – responsible for growth in the length of the bone;

Periosteum – a layer of dense connective tissue covering the outer part of the bone (except at the joint);

Endosteum – a layer of dense connective tissue covering the bone from the inner side.

2. Vertebral column

Forms basic structure of trunk. Consists of 33 – 34 vertebrae and intervertebral disks. Divided into 7 cervical (C1-C7), 12 thoracic (T1-T12), 5 lumbar (L1-L5), 5 sacral (S1-S5), 4-5 coccygeal. Sacral and coccygeal are false vertebrae and the others are true vertebrae. A typical vertebra consist of vertebral body and a posterior vertebral arch.

Curvatures: In sagittal plane column shows two anteriorly convex secondary curvatures, lordoses (cervical, lumbar) and two posteriorly convex primary curvatures kyphoses (sacral, thoracic).

Movements: forward and backward bending flexion – extension occur in cervical and lumbar spine. Rotation in thoracic and cervical region.

Intervertebral disks: consists of outer tense, annulus fibrosus and soft nucleus, nucleus pulposus. Liw between hyaline cartilage plates derived from epiphyses of vertebral bodies. Are held in position by longitudinal ligaments. Intervertebral disks + longitudinal ligaments together are known as intervertebral symphysis. Intervertebral disk between 5th lumbar and sacrum called promontory.

Ligaments of vertebral column: anterior longitudinal ligament. Posterior longitudinal ligaments (deep, superficial layers). Ligamenta flava. Ligamentum nuchae, intertransverse ligaments, interpinous ligaments, supraspinous ligaments. Longitudinal ligaments restrict movement and protect disks.

3. Thoracic skeleton

The 12 vertebrae each have a vertebral body which has incompletely ossified cranial and caudal plates of compact bone. On dorsal surface has openings for exit of vertebral veins. Laterally has two costal facets, each of which half of articular facets. Exceptions are vertebrae I (complete articular facet at cranial border half facet at caudal), X (one half articular facet), XI (complete articular facet at cranial border), XII (articular facet for head of rib). From the posterior surface of the body arises the vertebral arch with the pedicles that continue on each side into laminae of vertebral arch. Laminae unite to form the spinous process. On the upper margin of arches pedicle is superior vertebral notch and on lower margin the inferior vertebral notch. Vertebral foramen lies between vertebral arch and posterior surface of body. Cranially is the superior articular process and caudally the inferior articular process. Laterally and posteriorly lie the transverse process which carry costal facet of I-X vertebrae.

4. Neurocranium

Skull or cranium forms upper end of trunk. Consists of neurocranium (brain box) and viscerocranium (facial skeleton). Boundary between the two lies in region of root of nose and extends along the upper margin of the orbits to the external auditory meatus. Consists of occipital bone, sphenoid bone, squamous and mastoid portions of petrous parts of temporal bones, parietal bones, frontal bone.

Lateral view of the skull: in orbitomeatal plane, planum temporale is shown (parts of temporal, parietal, frontal, sphenoidal bones). Temporal fossa is limited above by inferior temporal line and superior temporal line. The zygomatic process extends anteriorly and with the temporal process of the zygomatic bone form zygomatic arch. Inferior to root of zygomatic process lies the external acoustic meatus bordered by tympanic part and squamous part. Above it is the suprameatal spine and a cavity (foveola suprameatica – suprameatal triangle) posterior to external meatus lies the mastoid process. Between the mastoid process and tympanic part is the tympanomastoid fissure. Below the tympanic part there is the styloid process.

Posterior view of the skull: dorsally both parietal bones are visible and joined by sagittal suture. The lambdoid suture separates parietal and occipital. Heist nuchal line extends upwards and below the superior nuchal line. Below it is the inferior nuchal line which may begin at external occipital crest. Lateral is the mastoid process which is joined to occipital by occipitomastoid suture. On medial side is the mastoid notch and medial to it the groove for occipital artery. Parietal foramina – parietal bones.

Sutures: coronal (frontal and parietal separated), sphenosquamous, squamous, sphenoparietal, sphenofrontal. Frontozygomatic, zygomaticomaxillary, frontomaxillary, temporozygomatic, nasomaxillary. Parietomastoid.

5. Viscerocranium (facial skeleton)

Composed of: ethmoid bone, lacrimal bone, nasal bone and inferior nasal conchae, maxillae and mandible, zygomatic bone, tympanic part and styloid process.

Lateral view of skull: above the orbit is the supraciliary arch. Below is the supra orbital margin which continues into infra orbital margin. The latter is formed by zygomatic bone and frontal process of maxilla. Medially is the fossa for lacrimal sac. There are two zygomaticofacial foramina. Below infraorbital margin lies infraorbital foramen. At lowest point of nasal opening is the anterior nasal spine. Mandible consists of body and ascending ramus on each side. Ramus has anterior coronoid process and posterior condylar process.

Anterior view of the skull: between supracondylar arches lies the Glabella. Frontal bone marks the entrance to orbits by forming supraorbital margin with supraorbital notch. Frontal bone separated [a] nasal bones – by frontonasal suture. [b] maxillae – by frontomaxillary suture. [c] zygomatic bone – by frontozygomatic suture. Two nasal bones joined by internasal suture. Inferior to orbit there is a deep depression the canine fossa. Palatine process directed

medially. In upper jaw is the alveolar process. Maxilla and nasal bone are connected by nasomaxillary suture. Continuation of infra orbital margin is the anterior crest.

6. External surface of cranial bone

Anterior part: formed by palatine process of maxilla, horizontal plate bone, the alveolar process and tuber of maxilla and the zygomatic bone. Vomer borders choanae medially. Two palatine process fuses at median palatine suture, anterior end of which is indicated by incisive fossa. An incisive suture is often present. Palatine bones plates contains greater and lesser palatine foramina. Transverse palatine suture found between maxilla and bone palatine.

Posterior part: consist of temporal and occipital bones. Pterygoid process form lateral borders of choanae. Medial and lateral plate and between them the pterygoid fossa. At roof of medial plate is the scaphoid fossa and next the lacerum foramen. In the center lies the body of sphenoid bone and laterally its greater wing with the infratemporal crest. Greater wing bears the sphenoid spine whose base is pierced by foramen spinosum. Between foramen spinosum and lacerum lies foramen ovale. Between sphenoid bone and petrous part is sphenopetrosal fissure – auditory tube extends and styloid process. On mastoid process is the mastoid notch and medial the occipitomastoid suture with occipital artery. Anterior to mastoid process lies external acoustic meatus bounded by tympanic and squamous part. Tympanic squamous part and tegmental crest from mandibular fossa. Its limited anteriorly by articular tubercle. Zygomatic process of temporal bone extends anterolaterally. The basilar part of occipital bone which bears pharyngeal tubercle fuses with body of sphenoid bone. Foramen magnum is bordered laterally on each side by an occipital condyle behind which lies condylar fossa perforated by condylar canal. Beginning behind foramen magnum, the external occipital crest passes upward to external occipital protuberance.

7. Internal surface of cranial base

Inner surface by ethmoid bone, frontal bone, sphenoid bone, temporal bone, occipital bone, parietal bone. Divided into: anterior cranial fossa, middle cranial fossa, posterior cranial fossa. Anterior and middle separated by lesser wings of sphenoid and jugum sphenoidale. Middle and posterior separated by superior borders of petrosal portions of temporal bone and dorsum sellae.

Anterior cranial fossa: cribriform plate bears in midline the vertical crista galli. Anterior to crista galli is the foramen caecum and laterally the orbital plates of frontal bone. Cribriform plate and sphenoid bone joined by sphenoid ethmoidal suture. In the midline prechiasmatic groove lies between optic canals. Bordered by anterior clinoid processes.

Middle cranial fossa: in the center lies sella turcica with hypophysial fossa and lateral the carotid sulcus (prolongation of carotid canal). Carotid canal splits open near foramen lacerum. The medial end is bounded by sphenoidal lingula. Lateral to carotid groove is the foramen ovale and spinosum and in front the foramen rotundum. Groove for middle meningeal artery runs laterally from foramen spinosum. Near the apex of petrous part, trigeminal impression is visible and lateral is hiatus for greater petrosal nerve which continues as groove for greater nerve. Hiatus for lesser petrosal nerve lies anterolateral. Superior border of petrous part carries groove of superior petrosal sinus. Swelling (arcuate eminence) is produced.

Posterior cranial fossa: foramen magnum lies in the middle. Clivus ascends anterolaterally ends in dorsum sellae and its posterior clinoid processes. Between occipital and petrous part lies groove of inferior petrosal sinus and petro occipital fissure. Groove ends in jugular foramen. Jugular foramen divided by intrajugular process of temporal bone. On either side of foramen magnum is the opening for hypoglossal canal.

8. Orbit

Each orbit shaped like a four – sided pyramid. The apex lying deep inside and the base forming the orbital opening. The roof is formed anteriorly by orbital plate of frontal bone. Posteriorly by lesser wing of sphenoid. Lateral wall consists of zygomatic bone and greater wing of sphenoid. The floor is formed anteriorly by body of maxilla and by zygomatic bone, posteriorly by orbital plate of palatine. Medial wall is formed by ethmoid bone, lacrimal bone, sphenoid bone.

Orbital openings: supra orbital and infra orbital margins. Medially and laterally are joined together by medial and lateral margins. Posteriorly there are two converging fissures the superior and inferior orbital fissures. Fissures converge medially above junction lies optic canal. From inferior fissure runs infra orbital groove which becomes infra orbital canal to open below as the infra orbital foramen. On medial wall are anterior and posterior ethmoidal foramina. Near the entrance into the orbit lies the fossa for lacrimal sac which is bounded by anterior and posterior lacrimal crests.

9. Bony nasal cavity

Right and left bony nasal cavity separated by nasal septum. Nasal cavities open anteriorly into piriform aperture and posteriorly via choana into pharynx. Nasal septum has cartilaginous elements and it's a bony structure. Cartilaginous septum with its posterior process completes bony partition between 2 nasal cavities. Medial crus of major alar cartilage on anterior nose opening. Bony septum formed by perpendicular plate of ethmoid – sphenoidal crest – vomer. The bottom/floor formed by maxilla and palatine bone. Roof is formed by nasal bone and cribriform plate of ethmoid. Lateral wall is made irregular by 3 turbinate bones the conchae nasals and underlying ethmoidal cells. Superior and middle conchae belong to ethmoid bone while inferior nasal concha is a separate bone. After removal of 3 conchae – superior, medial, inferior, nasal meatus are revealed and perpendicular plate of palatine bone. In posterior meatus – openings of ethmoidal cells, sphenoidal recess, sphenopalatine foramen. In middle meatus – unciniate process covers the maxillary hiatus. Superior is the ethmoidal bulla – large ethmoidal cell. Between ethmoidal bulla and unciniate process is the ethmoidal infundibulum across which frontal and maxillary sinuses connect to nasal cavity. Uncinate process also covers lacrimal bone. Nasal opening of nasolacrimal canal lies inferior meatus.

10. Skull at birth

Ossification of skull: 2 developmental processes [a] chondrocranium replacement bone formation, in cartilage [b] desmocranium bones develop as membranous bones from condensation in connective tissue. Chondrocranium – occipital, sphenoid, petrous part of temporal bone, auditory ossicles, ethmoid, hyoid, inferior nasal concha, styloid process. Desmocranium – tympanic part, maxilla, mandible, zygomatic, parietal, frontal, mastoid part, upper occipital, vomer, nasal, lacrimal bone, palatine bone.

Features of intermembranous ossification: bone formation radiates in all directions. Paired protuberances develop two frontal eminences and two parietal eminences. Bones develop from these eminences. At birth, large connective tissue areas, the fontanelles or fonticuli are still between individual bones. Anterior fontanelle closed by connective tissue lies between frontal bone anlagen and occipital anlagen. Posterior fontanelle closed by connective tissue lies between parietal anlagen and occipital anlagen. Sphenoidal fontanelle closed by connective tissue lies between frontal, parietal and sphenoid bones. Mastoid fontanelle closed by cartilage lies between sphenoid, temporal and occipital bones. Fontanelles become closed after birth. Posterior – 3rd month. Anterior – 36th month. Sphenoid – 6th. Mastoid – 18th.

11. Pectoral girdle(shoulder girdle)

Scapula (the followings should be identified): Superior angle; Superior margin; Superior

notch; Neck; Medial angle; Medial margin; Subscapular fossa; Infraglenoid tubercle; Lateral margin; Inferior angle; Coracoid process; Glenoid cavity; Supraspinous fossa; Spine of capula; Infraspinous fossa; Groove for circumflex scapular vessels; acromion; supraglenoid tubercle. Surface projection: 2nd-7th ribs **Positioning**: position the spine posteriorly, the glenoid cavity laterally and the inferior angle inferiorly.

Clavicle: Acromial extremity; sternal extremity; trapezoid line; conoid tubercle, subclavius muscle; impression for costoclavicular ligament (costal tubercle). **Positioning**: position the rounded, bulky end medially; position the arch near this end anteriorly and the smooth side superiorly. Functions: to allow the limb maximal freedom of motion by keeping it away from the trunk; forms the cervicoaxillary canal (protection of the neurovascular bundle); transmits shock from the limb to the axial skeleton.

12. Free part of upper limb

Humerus:

Head of humerus; anatomical neck; surgical neck; greater tubercle; lesser tubercle; intertubercular groove (bicipital groove); deltoid tuberosity; medial and lateral condyles; medial and lateral epicondyles; capitulum; radial fossa; coronoid fossa; trochlear; groove for radial nerve; groove for ulnar nerve; olecranon fossa. **Positioning**: position the head superiorly and medially. Position the olecranon fossa posteriorly. Common site of fracture: surgical neck. The following parts of the humerus are in direct contact with the indicated nerves:

Surgical neck: axillary nerve; Radial groove: radial nerve; Distal end of humerus: median nerve; Medial epicondyle: ulnar nerve These nerves may be injured when the associated parts are fractured.

Radius

Head; neck; radial tuberosity; anterior and posterior margins; anterior and posterior surfaces; interosseous margin; styloid process; groove for extensor pollicis longus muscle; groove for extensor digitorum and extensor indicis muscles; groove for extensor carpi radialis longus and brevis muscles; area for extensor pollicis brevis and abductor pollicis longus muscles; articulating surfaces for scaphoid bone and lunate bone; ulnar notch of radius.

Positioning: position the head proximally, the styloid process inferiorly and laterally. Position the radial tuberosity anterolaterally.

Ulna

Olecranon; trochlear notch; coronoid process; radial notch of ulna; tuberosity of ulna; anterior and posterior surfaces and margins; interosseous margin; styloid process. **Positioning**: position the trochlear notch proximally and facing forward. The styloid process should face medially.

Wrist

The 8 carpal bones should be positioned in 2 rows. First row (1^o): Scaphoid; lunate; triquetrum; pisiform; Second row (2^o): trapezium; trapezoid; capitate; hamate.

Metacarpal bones: Head; body; base (proximal)

Phalanges: Head; body and base

13. Pelvic girdle

Bony pelvis: The bony pelvis is strong. Main function is to transfer the weight of the upper body from the axial to the lower appendicular skeleton and to withstand compression and other forces resulting from its support of body weight. In adults, the pelvis is formed by 4 bones- Hip bone (2 such), sacrum, and coccyx.

Hip bone

The mature hip bone the large flat¹ bone formed by the fusion of the ilium, ischium and pubis at the end of the teenage years. This bone connects the trunk (sacrum) and the lower limb femur). The two hip bones, which with the sacrum and coccyx form most of the bony pelvis, are united anteriorly by the pubic symphysis (is a fibrocartilaginous fusion between two bones.).

Ilium- composes the largest part of the hip bone and contributes to the superior part of the acetabulum. The ilium is composed of:

1. wing-like surface- **ala**- which provides attachment for the gluteal muscles laterally and the iliacus m. medially. The Ala is composed of: medial, intermediate and lateral lips (abdominal m. insertion point) tubercle of the iliac crest.
2. Iliac spines- * anterior superior * anterior inferior * posterior superior * posterior inferior
3. Gluteal lines- anterior, posterior and inferior gluteal lines
4. iliac fossa- auricular surface; (ear shape) with a tuberosity at its side.
5. the arcuate line transform weight of the body from the femur to the sacrum.
6. the body of the ilium joins with the body of the ischium and the superior ramus of pubis to form the acetabulum.

Ischium- composes the posteroinferior part of the bone. The superior part of the body of the ischium fuses with the body of the ilium and pubis to form the posteroinferior aspect of the acetabulum.

The **ramus of the ischium** joins the inferior ramus of the pubis to form a bar of bone- **the ischio pubic ramus**-that constitutes the inferiormedial boundary of the **oburator foramen**.

The obturator membrane closes the obturator except at its superior anterior side, at the obturator groove. This makes the obturator groove a canal, the **obturator canal** (contains the obturator artery, vein and nerve).

Pubis

Composes the anteromedial part of the hip bone and contributes the anterior part of the acetabulum. The pubis is divided into a flattened body and two rami, superior and inferior.

Medially, the symphyseal surface of the body of the pubis articulates with the corresponding surface of the contra-lateral pubis by means of the pubic symphysis. The anterosuperior border of the united bodies and symphysis form the pubic crest.

Small projections at the lateral ends of the crest, the pubic tubercles, are extremely important landmarks of the inguinal region. The posterior margin of the superior ramus of the pubis has a sharp raised edge- the pectin pubis (pectineal line)- which is part of the pelvic brim.

Is a large oval or irregularly triangular aperture in the hip bone. It is bounded by the pubis and ischium and their rami. Except for a small passageway for the obturator nerve and vessels-the obturator canal, the obturator foramen is closed by a thin, strong obturator membrane, covered on both sides by attached muscles.

14. Free part of lower limb

The femur is the longest and heaviest bone in the body. It transmits body weight from the hip bone to the tibia when a person is standing. Its length is estimated at 1/4 of a person's height. The femur consists of a body, and two ends superior and inferior. The superior end of the femur consists of a head, neck and **two trochanters (greater and lesser)**.

Head of the femur-

Projects superiomedially and slightly anteriorly with the acetabulum. The head is attached to the femoral body by the **neck of the femur**. The head and neck are at $\sim 125^\circ$ to the long axis of the body of the femur. The angle is widest at birth and diminished gradually until the adult angle is reached. It is less in females because of the increased breadth of the lesser pelvis (a.k.a pelvis minor or true pelvis) and the greater obliquity of the body of the femur.

Where the neck of the femur joins the body, **Lesser trochanter**- rounded and conical shaped. Extends medially from the posteromedial part of the junction of the neck and body. **Greater trochanter**-large, placed laterally bony mass that projects superiorly and posteriorly where the neck joins the femoral body. The site where the neck joins the body is indicated by the **intertrochanteric crest**- where the trochanters join posteriorly. The rounded elevation on the crest is the **quadrate tubercle**. Notice the greater trochanter is in line with the femoral body and overhangs a deep depression medially-**trochanteric fossa**. The **body of the femur** is slightly bowed anteriorly. Most of the body is smoothly rounded except for a broad, rough line posteriorly- the **linea aspera**. This vertical ridge is especially prominent in the middle third of the femoral body, where it has **medial** and **lateral lips** (margins). Superiorly, the lateral lip blends with the broad, rough **gluteal tuberosity**², and the medial lip continues as a narrow, rough spiral line. The **spiral line** extends toward the lesser trochanter and then passes to the anterior surface of the femur, where it ends on the intertrochanteric line. A prominent intermediate ridge- the **pectineal line**-extends from the central part of the linea aspera to the base of the lesser trochanter. Inferiorly, the linea aspera divides into medial and lateral **supracondylar lines** that lead to the spirally curved medial and lateral condyles. The condyles are separated inferoposteriorly by an **intercondylar fossa** (or notch). The **femoral condyles** articulate with the **tibial condyles** to form the knee joint. Anteriorly, the femoral condyles merge at a shallow depression- the **patellar surface** – where they articulate with the patella. The lateral surface of the lateral condyle has a central projection- the lateral epicondyle. The medial surface of the medial condyle has a large and more prominent **medial epicondyle**, superior to which is another elevation, the **adductor tubercle**. The trochanters, lines, epicondyles are where muscles and ligaments attach.

Tibia and Fibula The tibia and fibula are the bones of the leg. Their bodies are connected by an interosseous membrane composed of strong oblique fibers.

Tibia Function in weight bearing, is the 2nd largest bone in the body. The tibia is located on anteromedial side of the leg, nearly parallel to the fibula. The proximal end of the tibia is large because the **medial** and **lateral condyles** articulate with the large condyles of the femur. The superior surface of the tibia consists of the medial and lateral tibia condyles and an **intercondylar eminence**. This eminence of the tibia fits into the condyles. The lateral tibia condyle has a facet inferiorly for the head of the fibula.

Fibula

The slender fibula lies posterolateral to the tibia and serves mainly for muscle attachment. The fibula has no function in weight bearing, but its malleolus helps hold the talus in its socket. At its proximal end, is the **head of the fibula**, which has a pointed apex. The head articulates with the proximal posterolateral part of the tibia on the inferior aspect of the lateral condyle. The **body** of the fibula is twisted and marked by the sites of muscular attachments. It has 3 borders (anterior, interosseous and posterior) and 3 surfaces (medial, posterior and lateral). At its distal end, the fibula enlarges to form the **lateral malleolus**, which is the more prominent and posterior than the medial malleolus and extends approximately 1 cm more distally. The lateral malleolus articulates with the lateral surface of the talus.

Bones of the Foot Are comprised of the tarsus, metatarsus and phalanges. There are 7 tarsal bones, 5 metatarsal bones and 14 phalanges.

Tarsus Consists of 7 bones: calcaneus, talus, navicular, 3 cuneiforms.

Only one bone, the talus articulates with the leg bones.

Metatarsus Consists of 5 bones that are numbered from the medial side of the foot. The 1st metatarsal is shorter. The 2nd is the longest. Each metatarsal has a base proximally, a body and a head distally. The bases of the metatarsals articulate with the cuneiform and cuboid bones and the heads articulate with the proximal phalanges. The base of the 5th metatarsal has a large tuberosity that projects over the lateral margin of the cuboid. On the plantar surface of the heads of the 1st metatarsal are prominent medial and lateral sesamoid bones, they are embedded into the plantar ligaments.

15. General anatomy of joints.

A joint is the location at which two or more bones make contact. They are constructed to allow movement and provide mechanical support, and are classified structurally and functionally.

Classification: joints are mainly classified structurally and functionally. Structural classification is determined by how the bones connect to each other, while functional classification is determined by the degree of movement between the articulating bones. In practice, there is significant overlap between the two types of classifications.

Structural classification: Structural classification names and divides joints according to how the bones are connected to each other. There are three structural classifications of joints: fibrous joint - joined by dense irregular connective tissue that is rich in collagen fibers. Cartilaginous joint - joined by cartilage. Synovial joint - not directly joined - the bones have a synovial cavity and are united by the dense irregular connective tissue that forms the articular capsule that is normally associated with accessory ligaments.

Functional classification: Joints can also be classified functionally, by the degree of mobility they allow:

- synarthrosis – permits little or no mobility. Most synarthrosis joints are fibrous joints (e.g., skull sutures).
- amphiarthrosis – permits slight mobility. Most amphiarthrosis joints are cartilaginous joints (e.g., vertebrae).
- diarthrosis – permits a variety of movements. All diarthrosis joints are synovial joints (e.g., shoulder, hip, elbow, knee, etc.), and the terms “diarthrosis” and “synovial joint” are considered equivalent.

Biomechanical classification

Joints can also be classified based on their anatomy or on their biomechanical properties. According to the anatomic classification, joints are subdivided into *simple* and *compound*, depending on the number of bones involved, and into *complex* and *combination* joints:

1. Simple Joint: 2 articulation surfaces (eg. shoulder joint, hip joint)
2. Compound Joint: 3 or more articulation surfaces (eg. radiocarpal joint)
3. Complex Joint: 2 or more articulation surfaces and an articular disc or meniscus (eg. knee joint)

16. Vertebral joints

Zygapophysial joints: vertebral synovial joints b/w articular processes. Enable joints to bear greater load. In cervical region :flexion and limited extension. Thoracic: mainly rotation. Lumbar: flexion & extension.

Uncovertebral joints: found in cervical region. Develop secondarily.

Lumbosacral joints: articulation of 1st lumbar vertebra with sacrum. Iliolumbar ligament protects joint during flexion and rotation.

Sacrococcygeal joint; b/w sacrum and coccyx and is often a synovial joint. Strengthened by superficial lig & sacrococcygeal lig.

Atlantooccipital joint; sup articular facets of atlas and occipital condyles.

Atlantoaxial joint: consists of median and lateral atlantoaxial joints. Inferior articular facet of atlas join with superior articular facet of axis.

17. Thoracic joints

1. Costovertebral joints: each rib articulates with upper and lower borders of 2 vertebra. Exception: 1st, 11th, 12th ribs. Capsules is strengthened by radiate ligament of head of rib.

2. Sternoclavicular joint: Provides the only bony attachment between the appendicular and axial skeletons. Is a saddle-type synovial joint but has the movements of a ball-and-socket joint. Has a fibrocartilaginous articular surface and contains two separate synovial cavities.

3. Sternocostal (sternochondral) joints: Are synchondroses in which the sternum articulates with the first seven costal cartilages.

4. Costochondral joints: Are synchondroses in which the ribs articulate with their respective costal cartilages.

5. Costovertebral joints: except 11 & 12 all ribs articulate with transverse processes of vertebra so that the two joints are combined. Articular surfaces: articular facet of costal tubercle & costal fovea of transverse process.

18. Thorax as a functional unit

Ribs: bony part-os costale. Anterior cartilage=costal cartilage

12 pairs: 1-7 true ribs : directly to sternum

8-10 false ribs: indirectly joined. 11+12 : Not attached to sternum

Rib: head, neck, body->body b/w them defined by tubercle.

Heads and tubercle have the articular facet of tubercle that divide the crest of head of the rib.

Sternum: head manubrium, xiphoid process.

At cranial end of manubriums: jugular notch, clavicular notches lateral to each side, below costal notches.

Movements of thorax: widening: inspiration, expansion, expiration.

19. Joints of skull

Coronal: frontal+ parietal Sphenofrontal, frontozygomatic, frontomaxillary, nasomaxillary, zygomaticomaxillary, temporozygomatic, sphenosquamous, petrosquamous, squamous (temporal +parietal) sphenoparietal, parietomastoid, occipitomastoid, lamboid (parietal +occipital). Saggital (2 parietals), internasal (nasal bones), intermaxillary (maxilla), sphenoid, median palatine (2 palatine processes), transverse palatine (maxilla + palatine bone), incisive.

20. Temporomandibular joint

Is a combined **gliding** and **hinge** type of the **synovial joint** (ginglymoid-arthrodiar compound synovial joint) between the **mandibular fossa** and the **articular tubercle** of the temporal bone above and the **head** of the mandible below, and has **two** (superior and inferior) **synovial cavities** divided by an **articular disk** , which is an oval plate of **dense fibrous tissue**. Consists of an **upper gliding joint** (between the articular tubercle and mandibular fossa above and the articular

disk below where **forward gliding** or protrusion and **backward gliding** or retraction takes place) and a **lower hinge joint** (between the disk and the mandibular head [condylar process] where elevation [closing] and depression [opening] of the jaw takes place). During yawning, the disk and the condyle (head) of the mandible glide across the articular tubercle. Has an articular capsule that extends from the articular tubercle and the margins of the mandibular fossa to the neck of the mandible. Is reinforced by the **lateral (temporomandibular) ligament**, which extends from the tubercle on the zygoma to the neck of the mandible, and the **sphenomandibular ligament**, which extends from the spine of the sphenoid bone to the lingula of the mandible. Is innervated by the **auriculotemporal** and masseteric branches of the mandibular nerve. Is supplied by the superficial temporal, maxillary (middle meningeal and anterior tympanic branches), and ascending pharyngeal arteries.

21. Joints of pectoral girdle

Sternoclavicular joint – saddle joint that functions as ball and socket joint

The sternal end of the clavicle is attached to the clavicular notch of the manubrium via fibrocartilage

Tight capsule that inserts around the epiphysis of the clavicle and the clavicular notch of the sternum. The articular disc compensates the incongruity of the articulating surfaces, and functions mainly as shock absorber. It separates the joint into 2 compartments. Made of fibrocartilage. Ligaments: anterior and posterior sternoclavicular ligaments (attach to the disc); interclavicular ligament; costoclavicular lig.

No bursae. Elevation/depression (~60° in the sagittal plane); anterior/posterior mvmt (~25°); rotation along the long axis. Internal thoracic artery and suprascapular artery. The supraclavicular nerve and the subclavius nerve.

Acromioclavicular joint – plane joint The acromial end of the clavicle joins with the acromion of

the scapula. Both surfaces are lined with fibrocartilage. Relatively loose capsule. It is attached to the margins of There is an articular disc (fibrocartilage) dividing the Gliding and sliding Suprascapular artery and Ligaments: the acromioclavicular lig. (capsular); the coracoclavicular lig and the trapezoid lig are the most important stabilizers (extracapsular). No bursae.

22. Shoulder joint

Type: ball and socket

Articulating surfaces: Head of humerus – head, glenoid cavity and glenoid labrum – socket. The articular cartilage and the glenoid labrum are made of hyaline cartilage

Loose capsule. Originates around the bony rim of the glenoid cavity and inserts around the anatomical neck of the humerus. At the bicipital groove it gives a downward extension which houses the tendon of the long head of the biceps

There are no disks.

Ligaments: glenohumeral lig. (capsular); coracoacromial lig. Coracohumeral lig. Transverse humeral lig. (extracapsular)

Bursae (~12): subacromial bursa and subscapular bursa

Flexion/extension; abduction/adduction; medial and lateral rotation; circumduction

Circumflex humeral arteries and subscapular artery.

Suprascapular nerve, axillary n. and lateral pectoral n.

Capsule and ligaments are very loose to allow high degree of movements. Stability is thus compromised. The rotator cuff muscle provide dynamic stability: supraspinatus mm. infraspinatus mm. subscapularis mm. and teres minor mm.

23. Elbow joint

Forms a synovial **hinge joint** , consisting of the **humeroradial** and **humeroulnar joints** , and allows flexion and extension.

Also includes the **proximal radioulnar (pivot) joint** , within a common articular capsule. Is innervated by the musculocutaneous, median, radial, and ulnar nerves. Receives blood from the anastomosis formed by branches of the brachial artery and recurrent branches of the radial and ulnar arteries.

Is reinforced by the following ligaments:

1. **Annular ligament**

Is a fibrous band that forms nearly four fifths of a circle around the head of the radius; the **radial notch** forms the remainder.

Forms a collar around the head of the radius, fuses with the radial collateral ligament and the articular capsule, and prevents withdrawal of the head of the radius from its socket.

2. **Radial collateral ligament**

Extends from the lateral epicondyle to the anterior and posterior margins of the radial notch of the ulna and the annular ligament of the radius.

3. **Ulnar collateral ligament**

Is **triangular** and is composed of anterior, posterior, and oblique bands.

Extends from the medial epicondyle to the coronoid process and the olecranon of the ulna.

24. Joints of hand

1. **Proximal radioulnar joint:** Forms a synovial **pivot joint** in which the head of the radius articulates with the radial notch of the ulna and allows **pronation** and **supination**.

2. **Distal radioulnar joint:** Forms a synovial **pivot joint** between the head of the ulna and the ulnar notch of the radius and allows **pronation** and **supination**.

3. **Wrist (radiocarpal) joint:** Is a synovial **condylar joint** formed superiorly by the radius and the articular disk and inferiorly by the proximal row of carpal bones (scaphoid, lunate, and rarely triquetrum), exclusive of the pisiform. Has a capsule that is strengthened by radial and ulnar collateral ligaments and dorsal and palmar radiocarpal ligaments. Allows flexion and extension, abduction and adduction, and circumduction.

4. **Midcarpal joint:** Forms a synovial **plane joint** between the proximal and distal rows of carpal bones and allows gliding and sliding movements. Is a compound articulation: laterally, the scaphoid articulates with the trapezium and trapezoid, forming a **plane joint** ; and medially, the scaphoid, lunate, and triquetrum articulate with the capitate and hamate, forming a **condylar (ellipsoidal type) joint**.

5. **Carpometacarpal joints**

Form synovial **saddle (sellar) joints** between the carpal bone (trapezium) and the first metacarpal bone, allowing flexion and extension, abduction and adduction, and circumduction. Also form **plane joints** between the carpal bones and the medial four metacarpal bones, allowing a simple gliding movement.

6. **Metacarpophalangeal joints**

Are **condyloid joints** , supported by a palmar ligament and two collateral ligaments, and allow flexion and extension and abduction and adduction.

7. Interphalangeal joints

Are **hinge joints**, supported by a palmar ligament and two collateral ligaments, and allow flexion and extension.

25. Hip (Coxal) Joint

Is a **multiaxial ball-and-socket synovial joint** between the acetabulum of the hip bone and the head of the femur and allows abduction and adduction, flexion and extension, and circumduction and rotation. Is stabilized by the acetabular labrum; the fibrous capsule; and capsular ligaments such as the iliofemoral, ischiofemoral, and pubofemoral ligaments.

Has a cavity that is deepened by the fibrocartilaginous **acetabular labrum** and is completed below by the **transverse acetabular ligament**, which bridges and converts the **acetabular notch** into a foramen for passage of **nutrient vessels** and nerves.

Receives blood from branches of the medial and lateral femoral circumflex, superior and inferior gluteal, and obturator arteries. The posterior branch of the obturator artery gives rise to the artery of the ligamentum teres capitis femoris.

Is innervated by branches of the femoral, obturator, sciatic, and superior gluteal nerves and by the nerve to the quadratus femoris.

A. Structures

1. Acetabular labrum

Is a complete fibrocartilage rim that deepens the articular socket for the head of the femur and consequently stabilizes the hip joint.

2. Fibrous capsule

Is attached proximally to the margin of the acetabulum and to the transverse acetabular ligament. Is attached distally to the neck of the femur as follows: anteriorly to the intertrochanteric line and the root of the greater trochanter and posteriorly to the intertrochanteric crest. Encloses part of the head and most of the neck of the femur. Is reinforced anteriorly by the **iliofemoral** ligament, posteriorly by the **ischiofemoral** ligament, and inferiorly by the **pubofemoral** ligament.

26. Knee Joint

Is the largest and most complicated joint. Although structurally it resembles a hinge joint, it is a **condylar type of synovial joint** between two condyles of the femur and tibia. In addition, it includes a **saddle joint** between the femur and the patella.

Is encompassed by a **fibrous capsule** that is rather thin, weak, and incomplete, but it is attached to the margins of the femoral and tibial condyles and to the patella and patellar ligament and surrounds the lateral and posterior aspects of the joint.

Permits flexion, extension, and some gliding and rotation in the flexed position of the knee; full extension is accompanied by medial rotation of the femur on the tibia.

Is stabilized laterally by the biceps and gastrocnemius (lateral head) tendons, the **iliotibial tract**, and the fibular collateral ligaments.

Is stabilized medially by the sartorius, gracilis, gastrocnemius (medial head), semitendinosus, and semimembranosus muscles and the tibial collateral ligament.

Receives blood from the genicular branches (superior medial and lateral, inferior medial and lateral, and middle) of the popliteal artery, a descending branch of the lateral femoral circumflex artery, an articular branch of the descending genicular artery, and the anterior tibial recurrent artery. Is innervated by branches of the sciatic, femoral, and obturator nerves. Is supported by various ligaments and menisci/

A. Ligaments

1. *Intracapsular ligaments:* Anterior cruciate ligament Posterior cruciate ligament Medial meniscus Lateral meniscus

Transverse ligament

2. *Extracapsular ligaments* Medial (tibial) collateral ligament. medial meniscus. Lateral (fibular) collateral ligament

Patellar ligament (tendon). Arcuate popliteal ligament. Oblique popliteal ligament.

Movements: extension, flexion, rotation, circumduction

27. Joints of foot

1. Ankle (Talocrural) Joint :Is a **hinge-type (ginglymus) synovial joint** between the tibia and fibula superiorly and the trochlea of the talus inferiorly permitting dorsiflexion and plantar flexion.

A. Articular capsule Is a thin fibrous capsule that lies both anteriorly and posteriorly, allowing movement. Is reinforced medially by the medial (or deltoid) ligament and laterally by the lateral ligament, which prevents anterior and posterior slipping of the tibia and fibula on the talus.

B. Ligaments

Medial (deltoid) ligament

Has four parts: the tibionavicular, tibiocalcaneal, anterior tibiotalar, and posterior tibiotalar ligaments. Extends from the medial malleolus to the navicular bone, calcaneus, and talus. Prevents overeversion of the foot and helps maintain the medial longitudinal arch.

Lateral ligament

Consists of the anterior talofibular, posterior talofibular, and calcaneofibular (cord-like) ligaments.

Resists inversion of the foot and may be torn during an **ankle sprain** (inversion injury).

2. Tarsal Joints

A. Intertarsal joints

1. Talocalcaneal (subtalar) joint

Is a plane synovial joint (part of the talocalcaneonavicular joint), and is formed between the talus and calcaneus bones.

Allows inversion and eversion of the foot.

2. Talocalcaneonavicular joint

Is a ball-and-socket joint (part of the transverse tarsal joint), and is formed between the head of the talus (ball) and the calcaneus and navicular bones (socket).

Is supported by the **spring** (plantar calcaneonavicular) ligament.

3. Calcaneocuboid joint

Is part of the transverse tarsal joint and resembles a saddle joint between the calcaneus and the cuboid bones.

Is supported by the **short plantar** (plantar calcaneocuboid) and **long plantar** ligaments and by the tendon of the peroneus longus muscle.

4. Transverse tarsal (midtarsal) joint

Is a collective term for the **talonavicular part** of the talocalcaneonavicular joint and the calcaneocuboid joint. The two joints are separated anatomically but act together functionally. Is important in inversion and eversion of the foot.

B. Tarsometatarsal joints

Are **plane synovial joints** that strengthen the transverse arch. Are united by articular capsules and are reinforced by the plantar, dorsal, and interosseous ligaments.

C. Metatarsophalangeal joints

Are **ellipsoid (condyloid) synovial joints** that are joined by articular capsules and are reinforced by the plantar and collateral ligaments.

D. Interphalangeal joints

Are **hinge-type (ginglymus) synovial joints** that are enclosed by articular capsules and are reinforced by the plantar and collateral ligaments.

28. General anatomy of muscles

[a] Skeletal muscle: circular, convergent, parallel, fusiform, somatic nervous system, has origin and insertion, enclosed by epimysium (connective tissue), surrounded by perimysium, each muscle fiber is enclosed by endomysium, voluntary muscles.

[b] Cardiac muscles: involuntary muscles, forms myocardium (middle layer of heart), autonomic nervous system, contracts spontaneously without any nerve supply, form cardiac conducting system.

[c] Smooth muscles: somatic nervous system, involuntary and non – striated, circular and longitudinal in the walls of many visceral organs, undergoes rhythmic contraction → peristaltic waves.

[d] Fascia: fibrous sheet that envelops the body under the skin (subserous), superficial fascia – loose connective tissue (between dermis and deep fascia), deep fascia invests the muscles.

Large motor unit → 1 neuron – many muscle fibers → long trunk → thigh muscles

Small motor unit → 1 neuron few muscle fibers

Regeneration: skeletal muscle cannot divided but they can replaced individually by new muscle fibers. The new muscle is composed of disorganized mixture.

Skeletal muscle are able to growth.

Motor unit → explain the function of the muscles, destroy nerve cell → destroy the motor axon → paralysis → atrophy.

29. Muscles of back

Levator scapulae

Transverse processes of C1-C4 ins: Medial border of scapula C4-C5; dorsal scapular nerve

Elevates scapula; rotates glenoid cavity

Rhomboid minor

Spines of C7-T1, Root of spine of scapula

Dorsal scapular nerve (C5)

Adducts scapula

Rhomboid major

Spines of T2-T5 ins. To Medial border of scapula

Dorsal scapular nerve (C5)

Adducts scapula

Latissimus dorsi

Spines of T7-T12, thoracodorsal fascia, iliac crest, ribs 9-12 inserted to Floor of bicipital groove of humerus

Thoracodorsal nerve

Adducts, extends, and rotates arm medially; depresses scapula

Serratus posterior-superior

Ligamentum nuchae, supraspinal ligament, and spines of C7-T3, inserted to Upper border of ribs 2-5

Intercostal nerve (T1-T4)

Elevates ribs

Serratus posterior-inferior

Supraspinous ligament and spines of T11-L3 ins. To Lower border of ribs 9-12

Intercostal nerve (T9-T12)

Depresses ribs

III. Suboccipital Area

Rectus capitis posterior major: Spine of axis- Lateral portion of inferior nuchal line to Suboccipital fnx: Extends, rotates, and flexes head laterally

Rectus capitis posterior minor

Posterior tubercle of atlas to Occipital bone below inferior nuchal line

Suboccipital. Fnx: Extends and flexes head laterally

Obliquus capitis superior

Transverse process of atlas to Occipital bone above inferior nuchal line

Suboccipital fnx: Extends, rotates, and flexes head laterally

Obliquus capitis inferior

Spine of axis to Transverse process of atlas

Suboccipital. Fnx: Extends and rotates head laterally

30. Muscles of thorax

External intercostals

Lower border of ribs ins. To Upper border of rib below

Intercostal

Elevate ribs in inspiration

Internal intercostals

Lower border of ribs ins. To Upper border of rib below

Intercostal

Elevate ribs (interchondral part); depress ribs

Innermost intercostals

Lower border of ribs ins. To Upper border of rib below

Intercostal

Elevate ribs

Transversus thoracis

Posterior surface of lower sternum and xiphoid ins to Inner surface of costal cartilages

Intercostal

Depresses ribs

Subcostalis

Inner surface of lower ribs near their angles inserted to Upper borders of ribs 2 or 3 below

Intercostal

Elevates ribs

Levator costarum

Transverse processes of T7-T11 inserted to Subjacent ribs between tubercle and angle

Dorsal primary rami of C8-T11

Elevates ribs

31. Diaphragm

Central tendon and sternal/ costal/ lumbar muscle

Sternal part: arises from xiphoid process (forms sternocostal triangle). Costal parts: inner cartilages 6-12 which alternate with slips of abdominis transversus.

Lumbar part: medial/ intermediate/ lateral crus.

Right medial crus: from bodies of L1-L4. Left medial crus: from bodies of L1-L3.

Lateral crus: from 2 arches, medial arcuate ligament and psoas arcade and lateral arcuate ligament and quadratus arcade. Between lumbar and costal there is lumbosacral triangle.

Between sternal and costal: sternocostal triangle. Between medial crura: aortic hiatus (aorta and thoracic duct). Esophageal hiatus from median arcuate ligament and vagus nerve. Inferior vena cava opening and right phrenic nerve branch. Greater and lesser splanchnic nerves, azygos and hemiazygos veins are coming through median or intermediate crus. Sympathetic trunk between intermediate and lateral crura. Internal thoracic arteries and veins near sternocostal triangle.

Nerve supply: phrenic nerves.

Arteries and veins of superior surface: pericardiophrenic artery and vein. Musculophrenic artery and vein. Superior phrenic artery (from thoracic aorta).

Arteries of inferior surface: inferior phrenic artery and vein.

Lymph: anterior/ posterior diaphragmatic → parasternal → posterior mediastinal → phrenic lymph node → superior lumbar lymphs.

32. Muscles of abdomen

External oblique

External surface of lower eight ribs -> Anterior half of iliac crest; anterior-superior iliac spine; pubic tubercle; linea alba
Intercostal n. subcostal n. (T12)
Compresses abdomen; flexes trunk; active in forced expiration

Internal oblique

Lateral two thirds of inguinal ligament; iliac crest; thoracolumbar fascia to Lower four costal cartilages; linea alba; pubic crest; pectineal line
Intercostal n. subcostal n. (T12); iliohypogastric and ilioinguinal nn. (L1)
Compresses abdomen, flexes trunk, active in forced expiration

Transverse abdominis

Lateral one third of inguinal ligament; iliac crest; thoracolumbar fascia; lower six costal cartilages to Linea alba; pubic crest; pectineal line
Intercostal n. , subcostal n. (T12); iliohypogastric and ilioinguinal nn. (L1)
Compresses abdomen; depresses ribs

Rectus abdominis

Pubic crest and pubic symphysis to Xiphoid process and costal cartilages
Intercostal n. subcostal n. (T12)
Depresses ribs; flexes trunk

Pyramidal

Pubic body to Linea alba
Subcostal n. (T12)
Fnx: Tenses linea alba

33. Muscles of head

Occipitofrontalis

Superior nuchal line; upper orbital margin to Epicranial aponeurosis
Facial. Elevates eyebrows; wrinkles forehead (surprise)

Corrugator supercilii

Medial supraorbital margin to Skin of medial eyebrow
Facial fnx: Draws eyebrows downward medially (anger, frowning)

Orbicularis oculi

Medial orbital margin; medial palpebral ligament; lacrimal bone to Skin and rim of orbit; tarsal plate; lateral palpebral raphe
Facial. Closes eyelids (squinting)

Procerus

Nasal bone and cartilage to Skin between eyebrows

Wrinkles skin over bones (sadness)

Nasalis

Maxilla lateral to incisive fossa to Ala of nose

Draws ala of nose toward septum

Depressor septi*

Incisive fossa of maxilla to Ala and nasal septum

Constricts nares

Orbicularis oris

Maxilla above incisor teeth to Skin of lip fnx: Closes lips

Levator anguli Canine fossa of oris maxilla

Angle of mouth fnx: Elevates angle of mouth medially (disgust)

Levator labii superioris

Maxilla above infraorbital foramen to Skin of upper lip. Fnx: Elevates upper lip; dilates nares (disgust)

Levator labii superioris alaeque nasi*

Frontal process of maxilla to Skin of upper lip

Elevates ala of nose and upper lip

Zygomaticus major

Zygomatic arch to Angle of mouth. Draws angle of mouth backward and upward (smile)

Zygomaticus minor

Zygomatic arch to Angle of mouth

Elevates upper lip

Depressor labii Mandible below inferioris mental foramen

Orbicularis oris and skin of lower lip

Depresses lower lip

Depressor anguli oris

Oblique line of mandible to Angle of mouth

Depresses angle of mouth (frowning)

Risorius

Fascia over masseter to angle of mouth

Retracts angle of mouth (false smile)

Buccinator

Mandible; pterygomandibular raphe; alveolar processes to angle of mouth

Presses cheek to keep it taut

Mentalis

Incisive fossa of mandible to skin of chin

Elevates and protrudes lower lip

Auricularis anterior, superior, and posterior*

Temporal fascia; epicranial aponeurosis; mastoid process to anterior, superior, and posterior sides of auricle

Retract and elevate ear

34. Muscles of neck

Platysma

Superficial fascia over upper part of deltoid and pectoralis major Mandible; skin and muscles over mandible and angle of mouth. Facial n. fnx:Depresses lower jaw and lip and angle of mouth; wrinkles skin of neck

Sternocleidomastoid:

Manubrium sterni and medial one third of clavicle, Mastoid process and lateral one half of superior nuchal line

Spinal accessory n. fnx:Singly turns face toward opposite side; together flex head, raise thorax

Suprahyoid muscles

Digastric

Anterior belly from digastric fossa of mandible; posterior belly from mastoid notch Intermediate tendon attached to body of hyoid

Posterior belly by facial n.; anterior belly by mylohyoid n. of trigeminal n.

Fnx: Elevates hyoid and floor of mouth; depresses mandible

Mylohyoid

Mylohyoid line of mandible, Median raphe and body of hyoid bone

Mylohyoid n. of trigeminal n. Fnx:Elevates hyoid and floor of mouth; depresses mandible

Stylohyoid, Styloid process, Body of hyoid

Facial n. fnx: Elevates hyoid

Geniohyoid, Genial tubercle of mandible, Body of hyoid

C1 via hypoglossal n.

Elevates hyoid and floor of mouth

Infrahyoid muscles

Sternohyoid

Manubrium sterni and medial end of clavicle, Body of hyoid, Ansa cervicalis

Depresses hyoid and larynx

Sternothyroid

Manubrium sterni; first costal cartilage, Oblique line of thyroid cartilage, Ansa cervicalis

Depresses hyoid and larynx

Thyrohyoid

Oblique line of thyroid cartilage to Body and greater horn of hyoid

C1 via hypoglossal n.

Depresses hyoid and elevates larynx

Omohyoid

Inferior belly from medial lip of suprascapular notch and suprascapular ligament; superior belly from intermediate tendon

Inferior belly to intermediate tendon; superior belly to body of hyoid

Ansa cervicalis

Depresses and retracts hyoid and larynx

Muscles of the pectoral region and axilla				
muscle	origin	insertion	nerve	action
Pectoralis Major	clavicle sternum 1-6 ribs	Lateral lip of intertubercular groove of humerus (greater tubercle)	Lateral and medial pectoral n.	Flexes Abducts Medially rotation of the arm
Pectoralis minor	3,4,5 ribs	Coracoid process of scapula	Medial (and lateral) pectoral n. (C8,T1)	Depresses scapula; Elevates ribs
subclavius	1 st rib	clavicle	Nerve to subclavius (C5,C6)	Depresses lateral part of clavicle
Serratus anterior	Upper 1-8 rib (external surface of lateral parts)	Medial border of scapula (anterior surface)	Long thoracic n. (C5,C6,C7)	Rotates scapula upward Abducts scapula with arm and elevates it above horizontal
Muscles of the shoulder				
muscle	Origin	insertion	nerve	action
deltoid	Lateral third of clavicle acromion spine of scapula	Deltoid tuberosity of humerus	Axillary n. (C5,C6)	Abducts-adducts , Flexes- extends, and rotates the arm medially and laterally
supraspinatus	Supraspinous fossa of scapula	greater tubercle of humerus	Suprascapular n.(C4,C5,C6)	Abducts arm
infraspinatus	Infraspinous fossa	greater tubercle of humerus	Suprascapular n. (C5,C6)	Rotates arm laterally
subscapularis	Subscapular fossa	Lesser tubercle of humerus	Upper and lower subscapular nn.	Adducts and rotates arm medially
Teres minor	lateral border of scapula	greater tubercle of humerus	Axillary n. (C5,C6)	Rotates arm laterally
Teres major	inferior angle of scapula	Medial lip of intertubercular groove of humerus (lesser tubercle)	Lower subscapular n. (C5,C6)	Adducts and rotates arm medially

Levator scapulae	C1-C4 transverse processes	Medial border of scapula Superior to root of spine	Dors. Scapular C5 Cervical C3 , C4	Elevate scapula Rotate scapula
Rhomboid minor + major	Minor: nuchal lig. C7,T1 spinous processes Major:T2 – T5 spinous processes	Minor: medial end of scapular spine Major: medial border of scapula	Dors. Scapular C4, C5	Retract scapula and rotate it to depress glenoid cavity Fix scapula to thoracic wall
Latissimus dorsi	Spines of T7-T12 thoracolumbar fascia Iliac crest Ribs 9-12	Floor of intertubercular (bicipital) groove of humerus	Thoracodorsal n. (C6,C7,C8)	Adducts , extends and rotates arm medially (raises body to arm during climbing)
trapezius	Medial third of superior nuchal line External occipital protuberance Nuchal lig. Spinous processes of C7-T12 vertebrae	Lateral third of clavicle Acromion Spine of scapula	Accessory n.(CN XI)(motor fibers) C3,C4 spinal nn. (pain and proprioceptive fibers)	Descending parts: elevates Ascending parts: depresses Retract scapula Rotate glenoid cavity superiorly
Muscles of the arm				
muscle	Origin	insertion	nerve	action
Biceps brachii	Long head – supraglenoid tubercle of scapula Short head- coracoid process of scapula	Radial tuberosity off radius	Musculocutaneous n. (C5,C6)	Flexes arm and forearm Supinates for arm
coracobrachialis	Coracoid process	Middle third of medial surface of humerus	Musculocutaneous n. (C5,C6,C7)	Flexes and adducts arm Resists dislocation of shoulder
brachialis	Lower anterior surface of humerus	Coronoid process of ulna and ulnar tuberosity	Musculocutaneous n. (C5,C6)	Flexes forearm in all positions
triceps	1. long head- infraglenoid tubercle of scapula 2. lateral head- superior to radial groove of humerus 3. medial head- inferior to radial groove	Olecranon process of ulna	Radial n. (C6,C7,C8)	Extends forearm - long head resists dislocation of humerus
anconus	Lateral epicondyle of humerus	Olecranon (lateral surface) Upper posterior surface of ulna	Radial n. (C7,C8,T1)	Extends forearm -stabilizes elbow j.
Muscles of the anterior forearm				
muscle	Origin	insertion	nerve	action
Pronator teres	Medial epicondyle and coronoid process of ulna	Middle of lateral side of radius	Median n. (C6,C7)	Pronates and flexes forearm

Flexor carpi radialis (FCR)	Medial epicondyle of humerus	Bases of 2 nd and 3 rd metacarpal	Median n. (C6,C7)	Flexes forearm Flexes and abducts hand
Palmaris longus	Medial epicondyle of humerus	Flexor retinaculum Palmar aponeurosis	Median n. (C7,C8)	Flexes forearm and hand
Flexor carpi ulnaris (FCU)	Medial epicondyle of humerus Medial Olecranon Posterior border of ulna (ulnar head)	Pisiform Hook of hamatr Base of 5 th metacarpal	Ulnar n.	Flexes forearm Flexes and adducts hand
Flexor digitorum superficialis (FDS)	Medial epicondyle of humerus Coronoid process Oblique line of radius	Shafts (bodies) of 2-5 phalanges	Median n. (C7,C8,T1)	Flexes prox. Interphalangeal j. Flexes hand and forearm
Flexor digitorum profundus (FDP)	Anteromedial surface of ulna Interosseous membrane	Base of distal phalanges of fingers 2-5	Ulnar n. + median n.	Flexes distal interphalangeal jj. And hand
Flexor pollicis longus (FPL)	Anterior surface of radius Interosseous membrane Coronoid process	Base of dist. Phalanx of thumb (pollex)	Median n.	Flexes thumb (pollex)
Pronator quadratus	Anterior surface of dist. ulna	Anterior surface of dist. radius	Median n.	Pronates forearm

Muscles of the posterior forearm

muscle	Origin	insertion	Nerve	action
brachioradialis	Laeral supracondylar ridge of humerus	Base of radial styloid process	Radial n. (C5,C6,C7)	Flexes forearm (week) Max. flex when forearm is in midpronated position
Extensor carpi radialis longus (ECRL)	Laeral supracondylar ridge of humerus	Dorsum of base of 2 nd metacarpal	Radial (C6,C7)	Extends and abduct hand at the wrist j. Active during fist clenching
Extensor carpi radialis brevis (ECRB)	Lateral epicondyle of humerus	Posterior base of 3 rd metacarpal	Radial (C7,C8)	Extends and abduct hand
Extensor digitorum	Lateral epicondyle of humerus	Extensor expansion of middle and digital phalanges	Radial n.	Extends fingers (2-5) and hand (Primarily at metacarpophalangeal jj. Secondarily at interphalangeal

				jj.)
Extensor digiti minimi (EDM)	Common extensor tendon Interosseous membrane	Extensor expansion of middle and distal phalanges	Radial n.	Extends little finger (digitus minimus) Primarily at metacarpophalangeal j. Secondarily at interphalangeal j.
Extensor carpi ulnaris (ECU)	Lateral epicondyle of humerus Posterior surface of ulna	Base of 5 th metacarpal	Radial n.	Extends and abduct hand at the wrist j. Active during fist clenching
supinator	Lateral epicondyle of humerus Radial collateral and anular ligaments Supinator fossa Crest of ulna	Lateral side of upper part of radius	Radial n. (deep branch C7,C8)	Supinates forearm
Abductor pollicis longus (APL)	Interosseous membrane , middle 3 rd of posterior surface of radius and ulna	Lateral surface of base of 1 st metacarpal	Radial n.	Abducts thumb (pollex) and hand
Extensor pollicis longus (EPL)	Interosseous membrane Middle 3 rd of posterior surface of ulna	Base of distal phalanx of thumb (pollex)	Radial n.	Extends distal phalanx of thumb Abducts hand
Extensor pollicis bravis (EPB)	Interosseous membrane Posterior surface of middle 3 rd of radius	Base of proximal phalanx of thumb (pollex)	Radial n.	Extends proximal phalanx of thumb Abducts hand
Extensor indicis	posterior surface of ulna interosseous membrane	Extensor expansion of index finger	Radial n.	Extends index finger

Muscles of the hand

muscle	origin	insertion	Nerve	action
Abductor pollicis bravis	Flexor retinaculum Tubercles of scaphoid and trapezium	Lateral side of base of prox. Phalanx of thumb (pollex)	Median n.	Abducts thumb Help opposition
Flexor pollicis bravis	Flexor retinaculum and trapezium	base of prox. Phalanx of thumb (pollex)	Median n.	Flexes thumb
Opponens pollicis	Flexor retinaculum and trapezium	Lateral side of 1 st metacarpal	Median n.	Opposes thumb to other digits
Adductor pollicis	Capitate and bases of 2 nd and 3 rd	Medial side of base of proox. Phalanx	Ulnar n.	Adducts thumb

	metacarpals (oblique head) Palmar surface of 3 rd metacarpal (transverse head)	of the thumb		
Palmaris bravis	Medial side of flexor retinaculum Palmar aponeurosis	Skin of medial side of palm	Ulnar n.	Wrinkles skin on medial side of palm
Abductor digiti minimi	Pisiform Tendon of flexor carpi ulnaris	Medial side of base of prox. Phalanx of little finger (digitus minimus)	Ulnar n.	Abducts little finger (digitus minimus)
Flexor digiti minimi bravis	Flexor retinaculum Hook of hamate	Medial side of base of prox. Phalanx of little finger (digitus minimus)	Ulnar n.	Flexes prox. Phalanx of little finger
Opponens digiti minimi	Flexor retinaculum Hook of hamate	Medial side of 5 th metacarpal	Ulnar n.	Opposes little finger
lumbricals (4)	Lateral side of tendons of flexor digitorum profundus	Lateral side of extensor expansion	Median n. (two lateral) Ulnar n. (to medial)	Flex metacarpophalangeal jj. Extend interphalangeal jj.
Dorsal interossei (4)	Adjacent sides of metacarpal bones	Lateral side of bases of prox. Phalanges extensor expansion	Ulnar n.	Abduct fingers Flex metacarpophalangeal jj. Extend interphalangeal jj.
Palmar interossei (3)	Medial side of 2 nd metacarpal Lateral sides of 4 th and 5 th metacarpals	bases of prox. Phalanges in same sides as their origins extensor expansion	Ulnar n.	Abduct fingers Flex metacarpophalangeal jj. Extend interphalangeal jj.

Muscles of Gluteal Region

Muscle	Origin	Insertion	Nerve	Action
--------	--------	-----------	-------	--------

gluteus maximus	outer surface of ilium, sacrum, coccyx, sacrotuberous ligament	iliotibial tract and gluteal tuberosity of femur	inferior gluteal nerve (L5, S1, S2)	extends & laterally rotates thigh; through iliotibial tract, it extends knee joint
gluteus medius	outer surface of ilium	greater trochanter of femur	superior gluteal nerve (L5, S1)	abducts thigh. Tilts pelvis when walking
gluteus minimus	outer surface of ilium	greater trochanter of femur		abduct thigh; anterior fibers medially rotate thigh
tensor fasciae latae	iliac crest	iliotibial tract		assists gluteus major in locking the knee into full extension
piriformis	anterior surface of sacrum	greater trochanteric fossa	Branches of anterior rami of S1, S2)	laterally rotate extended thigh and abduct flexed thigh; steady femoral head in acetabulum
obturator internus	inner surface of obturator membrane	greater trochanteric fossa	Nerve to obturator internus (L5, S1) sacral plexus	
superior gemellus	spine of ischium	greater trochanteric fossa		
inferior gemellus	ischial tuberosity	greater trochanteric fossa	sacral plexus nerve to quadratus femoris (L5, S1)	
Quadratus femoris	Ischial tuberosity	Intertrochantric crest		Rotates thigh laterally; steady femoral head in acetabulum

Anterior Compartment of Thigh

Muscle	Origin	Insertion	Nerve	Action
iliacus	iliac fossa, iliac crest, ala of sacrum, anterior sacroiliac ligaments	with psoas into the lesser trochanter of femur	femoral nerve (L2, L3)	Act together in flexing thigh at hip joint and in stabilizing this joint
Psoas major	12th thoracic body; transverse process, bodies & intervertebral discs of the 5 lumbar vertebrae	lesser trochanter of femur along with iliacus	Anterior rami of lumbar nerves (L1, L2, L3)	
Psoas minor (variable, absence in 40%)	12th thoracic body; 1 st lumbar vertebrae	Pectineal line, iliopectineal eminence, iliac fascia laterally	Anterior rami of lumbar nerve (L1, L2)	
sartorius	anterior superior iliac spine	upper medial surface of tibia	femoral nerve (L2, L3)	flexes, abducts, laterally rotates thigh; flexes & medially rotates leg

pectineus	superior ramus of pubis	upper end shaft of femur	femoral nerve (L2, L3)	flexes and adducts thigh, assists with medial rotation of thigh
quadriceps femoris, rectus femoris	straight head from anterior inferior iliac spine; reflected head from ilium above acetabulum	quadriceps tendon into patella; into tibial tuberosity by patellar tendon	femoral nerve (L2, L3, L4)	extension of leg at knee joint; rectus femoris also steadies hip joint and helps iliopsoas flex thigh
quadriceps femoris, vastus lateralis	upper end and shaft of femur			
quadriceps femoris, vastus medialis	upper end and shaft of femur			
quadriceps femoris, vastus intermedius	shaft of femur			

Muscles of Medial Compartment of Thigh

Muscle	Origin	Insertion	Nerve	Action
gracilis	inferior ramus of pubis; ramus of ischium	upper part of shaft of tibia on medial surface	obturator nerve (L2, L3)	adducts thigh and flexes leg; helps rotate it medially
adductor longus	body of pubis	posterior surface of shaft of femur	obturator nerve, branch of anterior division (L2, L3, L4)	adducts thigh; assists in lateral rotation
adductor brevis	inferior ramus of pubis	Pectineal line, posterior surface of shaft of femur		adducts thigh; assists in lateral rotation
adductor magnus	inferior ramus of pubis; ramus of ischium, ischial tuberosity	posterior surface of shaft of femur near linea aspera; adductor tubercle of femur	Adductor part: obturator nerve, branch of anterior division (L2, L3, L4) Hamstring part: tibial part of sciatic nerve (L4)	adducts thigh and assists in lateral rotation; hamstring part extends thigh
Obturator externus	Outer obturator membrane; pubic & ischial rami	Medial surface of greater trochanter	Obturator nerve (L3, L4)	Laterally rotates thigh, steady femoral head in acetabulum

Muscles of Posterior Compartment of Thigh

biceps femoris	long head from ischial tuberosity; short head from shaft of femur	head of fibula	long head: tibial portion of sciatic nerve (L5, S1 , S2); short head: common fibular division of sciatic nerve (L5, S1 , S2)	flexes and laterally rotates leg when knee is flexed; long head extends thigh
semitendinosus	ischial tuberosity	upper part medial surface of shaft of tibia	tibial division of sciatic nerve part of tibia (L5 , S1 , S2)	Extend thigh; flex leg and rotate it medially when knee is flexed: when thigh and knee are flexed this muscle can extend trunk
semimembranosus		medial condyle of tibia; forms oblique popliteal ligament		
adductor magnus (hamstring part)	ischial tuberosity	adductor tubercle of femur	tibial nerve	extends thigh
Muscles of Anterior Compartment of the Leg				
Muscle	Origin	Insertion	Nerve	Action
tibialis anterior	shaft of tibia and interosseous membrane	medial cuneiform & base of 1 st metatarsal	deep fibular nerve (L4 ,L5)	extends the foot; inverts foot at subtalar and transverse tarsal joints; supports medial longitudinal arch
extensor digitorum longus	shaft of fibula and interosseous membrane	extensor expansion of lateral four toes	deep fibular nerve (L5, S1)	Extends 2-5 toes; dorsiflexes (extends) foot
extensor hallucis longus	shaft of fibula & interosseous membrane	Dorsal aspect of base of distal phalanx of big toe	deep fibular nerve (L5, S1)	extends big toe; dorsiflexes (extends) foot; inverts foot at subtalar and transverse tarsal joints
fibularis tertius	shaft of fibula & interosseous membrane	base of 5th metatarsal bone	deep fibular nerve (L5, S1)	dorsiflexes (extends) foot; everts foot at subtalar and transverse tarsal joints
Muscles of Lateral Compartment of Leg				
fibularis longus	shaft of fibula	base of 1st metatarsal & medial cuneiform	superficial fibular nerve (L5 , S1 , S2)	plantar flexes foot; everts foot at subtalar & transverse tarsal joints; supports lateral longitudinal and transverse arches of foot
fibularis brevis	shaft of fibula	base of 5th metatarsal bone		plantar flexes foot; everts foot at subtalar & transverse tarsal joints; supports lateral longitudinal arch
Muscles of Posterior Compartment of the Leg (SUPERFICIAL)				

gastrocnemius	lateral head: lateral condyle of femur medial head: superior to medial condyle	by way of Achilles tendon to calcaneum	tibial nerve (S1, S2)	Plantarflexes ankle when knee is extended; raises heel during walking; flexes leg at knee joint
plantaris	lateral supracondylar ridge of femur; oblique popliteal ligament			Weakly plantar flexes foot; flexes leg
soleus	shafts of tibia and fibula			with gastrocnemius & plantaris is powerful plantar flexor of foot; provides main propulsive force in walking & running
Muscles of Posterior Compartment of the Leg (DEEP)				
Muscle	Origin	Insertion	Nerve	Action
popliteus	lateral condyle of femur	shaft of tibia	tibial nerve (L4, L5, S1)	flexes leg; unlocks full extension of knee by laterally rotating femur on tibia
flexor digitorum longus	shaft of tibia;	distal phalanges of lateral four toes	tibial nerve (S2, S3)	flexes distal phalanges of lateral four toes; plantar flexes foot; supports medial and lateral longitudinal arches of foot
flexor hallucis longus	shaft of fibula; interosseous membrane	base of distal phalanx of big toe		flexes distal phalanx of big toe; plantar flexes foot; supports medial longitudinal arch
tibialis posterior	shafts of tibia and fibula & interosseous membrane	tuberosity of navicular bone; cuneiform; cuboid; bases of 2 nd , 3 rd , 4 th metatarsals	tibial nerve (L4, L5)	plantar flexes foot; inverts foot at subtalar and transverse tarsal joints; supports medial longitudinal arch of foot
Muscles on the Dorsum of Foot				
extensor digitorum brevis	calcaneum	by four tendons into the proximal phalanx of big toe and long extensor tendons to 2 nd , 3 rd , 4 th , 5 th toes	deep fibular nerve (L5, S1 or both)	extends toes
Extensor halucis brevis	Dorsal surface of calcaneus	Base of proximal phalanx of big toe		extends big toe
Muscles of the Sole of the Foot (First Layer)				

abductor hallucis	medial tubercle of calcaneum; flexor retinaculum	medial side, base of proximal phalanx of big toe		flexes, abducts big toe; supports medial arch
flexor digitorum brevis	medial tubercle of calcaneum	middle phalanx of four lateral toes	medial plantar nerve (S2, S3)	flexes lateral four toes; supports medial & lateral longitudinal arches
abductor digiti minimi	medial & lateral tubercles of calcaneus	lateral side base of proximal phalanx 5th toe	sfc. Br. Of lat plantar n.	flexes, abducts 5th toe; supports lateral longitudinal arch
muscles of Sole of Foot (Second Layer)				
Muscle	Origin	Insertion	Nerve	Action
flexor accessorius (quadratus plantae)	medial and lateral sides of calcaneum	tendons flexor digitorum longus	lateral plantar nerve (S2, S3)	aids long flexor tendon to flex lateral four toes
Lumbricals (4)	tendons of flexor digitorum longus	dorsal extensor expansion of lateral four toes	medial one: from medial plantar n. (S2, S3); lateral three: deep branch of lateral plantar nerve (S2, S3)	extends toes at interphalangeal joints
flexor digitorum longus tendon	shaft of tibia	base of distal phalanx of lateral four toes	tibial nerve	flexes distal phalanges of lateral four toes; plantar flexes foot; supports longitudinal arch
flexor hallucis longus	shaft of fibula	base of distal phalanx of big toe	tibial nerve	flexes distal phalanx of big toe; plantar flexes foot; supports medial longitudinal arch
Muscles of Sole of Foot (Third Layer)				

flexor hallucis brevis	cuboid, lateral cuneiform bones; tibialis posterior insertion	medial & lateral sides of base of proximal phalanx of big toe	medial plantar nerve (S2, S3)	flexes metatarsophalangeal joint of big toe; supports medial longitudinal arch
adductor hallucis (oblique head)	bases of 2nd, 3rd & 4th metatarsal bones	lateral side base of proximal phalanx big toe	deep branch of lateral plantar nerve(S2, S3)	flexes big toe, supports transverse arch
adductor hallucis (transverse head)	plantar ligaments	lateral side of base of proximal phalanx big toe		
flexor digiti minimi brevis	base of 5th metatarsal bone	lateral side of base of proximal phalanx of 5 th toe	superficial branch of lateral plantar nerve (S2, S3)	flexes little toe
Muscles of Sole of Foot (Fourth Layer)				
dorsal interossei (4)	adjacent sides of metatarsal bones	bases of phalanges and dorsal expansion of corresponding toes	lateral plantar nerve (S2, S3)	abduct toes with 2nd toe as the reference; flex metatarsophalangeal joints; extend interphalangeal joint
plantar interossei (3)	3rd, 4th, and 5th metatarsal bones	bases of phalanges & dorsal expansion of corresponding toes	lateral plantar nerve (S2, S3)	adduct toes with 2nd toe as reference; flex metatarsophalangeal joints; extend interphalangeal joints

43. Bursae and tendinous sheaths of upper limb

Bursae around the shoulder: Form a **lubricating mechanism** between the rotator cuff and the coracoacromial arch during movement of the shoulder joint.

Subacromial bursa: Lies between the coracoacromial arch and the supraspinatus muscle, and usually communicates with the subdeltoid bursa. Protects the supraspinatus tendon against friction with the acromion.

Subdeltoid bursa: Lies between the deltoid muscle and the shoulder joint capsule and usually communicates with the subacromial bursa.

Facilitates the movement of the deltoid muscle over the joint capsule and the supraspinatus tendon.

Subscapular bursa: Lies between the subscapularis tendon and the neck of the scapula. Communicates with the synovial cavity of the shoulder joint.

Tendinous sheaths:

Dorsum of hand: extensor retinaculum, septa, → 1st compartment: tendon of abductor pollicis longus, tendon of extensor pollicis brevis, → 2nd compartment: tendon of extensor carpi radialis longus and brevis, → 3rd compartment: tendon of extensor pollicis longus, → 4th compartment: sheath of extensor digitorum and indicis, → 5th compartment: sheath of extensor digiti minimi, → 6th compartment: sheath of extensor carpi ulnaris.

Palm of hand: flexor retinaculum, tendon sheath for flexor carpi radialis, sheath of flexor pollicis longus m, common synovial sheaths of flexor mm., anular and cruciate fibrous sheaths, tendon sheath of little, index, ring finger.

Carpal tunnel surrounded by flexor retinaculum, Anatomical snuffbox (dorsum), extensor expansion, palmar aponeurosis, extensor retinaculum.

44. Bursae and tendinous sheaths of lower limb

Bursae of lower limb

1. Suprapatellar bursa: Lies deep to the quadriceps femoris muscle and is the major bursa communicating with the knee joint cavity (the semimembranosus bursa also may communicate with it).

2. Prepatellar bursa: Lies over the superficial surface of the patella.

3. Infrapatellar bursa: Consists of a **subcutaneous infrapatellar bursa** over the patellar ligament and a **deep infrapatellar bursa** deep to the patellar ligament.

4. Anserine bursa (known as the pes anserinus [goose's foot]): Lies between the tibial collateral ligament and the tendons of the sartorius, gracilis, and semitendinosus muscles.

Tendinous sheaths:

Dorsum of foot, lat retromalleolar: tendinous sheaths of tibialis anterior, extensor hallucis longus, extensor digitorum longus, superior and inferior extensor retinacula, common peroneal tendinous sheath of peroneus, peroneus longus tendon, superior and inferior peroneal retinacula.

Medial maleolar: deep and superficial layer of flexor retinaculum, tendinous sheath of tibialis posterior, flexor digitorum longus, flexor hallucis longus.

Sole of foot: synovial sheaths of individual toes, stout fibrous sheaths, anular part, cruriform part, tendon sheaths for flexor hallucis longus and flexor digitorum longus.

PERIPHERAL NERVOUS SYSTEM

1. Oculomotor nerve

3rd cranial nerve: somatomotor fibers, visceromotor

Fibers exit from floor of interpeduncular fossa at medial margin of cerebral peduncle in the oculomotor sulcus. Here the nerve divides into superior and inferior branches.

Somatomotor fibers originate from the nucleus of the oculomotor nerve, which lies in the midbrain below the aqueduct at the level of the superior colliculi.

Parasympathetic visceromotor fibers originate from the Edinger-Westphal nucleus or accessory oculomotor nucleus. They run from the oculomotor nucleus to the ciliary ganglion and enter the eyeball to innervate the ciliary, sphincter pupillae.

Longitudinally arranged cell groups innervate specific muscles. Neurons for the inferior, superior, and medial rectus.

2. Abducent nerve

The 6th cranial nerve is exclusively somatomotor and innervates the lateral rectus muscle of the extraocular muscles.

Originates from the nucleus of the abducens nerve, which lies in the pons near the median plane.

Fibers → exit at the basal margin of the pons above the pyramid.

Injury to the abducent nerve

Because it has a long intercranial course, it is often stretched when the intercranial pressure rises due to bending over the petrous part of the temporal bone. A space-occupying lesion such as a brain tumor may compress the nerve, causing paralysis of the lateral rectus.

Complete paralysis causes medial deviation of the affected eye.

Diplopia is present in all ranges of eyeball movement except on gazing to the opposite site of the lesion.

Paralysis may occur from an aneurysm of the cerebral arterial circle, pressure from the internal carotid artery in the cavernous sinus, or septic thrombosis of the sinus.

3. Trochlear nerve

4th cranial nerve, exclusively somatomotor

Innervates the superior oblique muscle of the extraocular muscles.

Fibers originate from the nucleus of the trochlear nerve, which lies in the midbrain below the aqueduct at the level of the inferior colliculi.

It is the smallest C-N.

Fibers → emerge from the posterior surface of the midbrain, pass anteriorly around the brainstem, descend in the subarachnoid space to the base of the skull, enter the dura at the margin of the cerebellar tentorium, continue through the lateral wall of the cavernous sinus, enter the orbit through the superior orbital fissure.

Injury to the trochlear nerve or lesions of its nucleus cause paralysis of the superior oblique and impair the ability to turn the affected eyeball in the medial direction.

4. Vagus nerve

10th cranial nerve → supplies the head and also descends into the thorax and viscera.

It is the strongest parasympathetic nerve of the ANS and the most important antagonist of the sympathetic NS.

Fibers → emerge from behind the olive, unite to form the nerve trunk, leave the skull through the jugular foramen. In the foramen, the nerve forms the superior ganglion of the vagus.

It has the following components: motor fibers: for the branchial arch muscles, originate from the ambiguous nucleus; somatotopic organization; visceromotor which lies in the floor of the rhomboid fossa – originate in the posterior nucleus of the vagus; exteroceptive sensory fibers: originate from the superior ganglion; viscerosensory, taste fibers.

Head region: meningeal branch, auricular branch.

Thoracic and abdominal part: forms the pulmonary plexus at the hilum of the lung.

Esophageal plexus → superior and posterior vagal trunks, which extend to the stomach.

Hepatic branches run to the hepatic plexus.

Celiac branches to the celiac plexus.

Renal branches to the renal plexus.

Cervical region: nerve descends in neck with internal and common carotid arteries and jugular vein and emerges with them through upper thoracic aperture, giving branches: pharyngeal branches at level of inferior ganglion, superior laryngeal nerve originates below inferior ganglion, recurrent laryngeal branches off in thorax.. cervical cardiac branches

5. Trigeminal nerve

Ophthalmic, maxillary, mandibular

5th cranial nerve → motor fibers for masticatory muscles, sensory fibers

Emerges from pons with thick sensory root, thinner motor root

Trigeminal ganglion lies in dural pocket, the trigeminal cave and gives off: ophthalmic, maxillary, mandibular

Motor fibers for masticatory muscles: mylohyoid muscle, anterior belly of digastric muscle, tensor muscle of velum palatinum, tensor muscle of tympanic membrane..

Sensory fibers originate in trigeminal ganglion.. fibers of epicritic sensibility, protopathic..

Fibers descend as spinal tract and terminate somatically

Ophthalmic nerve: V1 gives off tentorial branch divides into lacrimal, frontal, nasociliary nerve..

Branches pass through superior orbital fissure in orbit.

Lacrimal nerve: enters through lateral section of fissure, runs to lacrimal gland, innervates skin of lateral corner of eye

Frontal nerve divides into supratrochlear, supraorbital

Nasociliary nerve gives off communicating branch to ciliary ganglion, long ciliary nerves to eyeball, posterior ethmoidal nerve to sphenoid and ethmoid sinuses, anterior ethmoidal nerve runs through

6. Trigeminal nerve-maxillary nerve:

Gives off meningeal branch and then passes through round foramen into pterygopalatine fossa where it divides into zygomatic nerve, ganglionic branches, infraorbital nerve.

Zygomatic nerve reaches through inferior orbital fissure, gives off communicating branch to lacrimal nerve and divides zygomaticotemporal, zygomaticofacial

Ganglionic branches, fibers provide sensory innervations to upper pharynx, nasal cavity, hard and soft palates

Infraorbital nerves: reaches through inferior orbital fissure. gives off posterior superior alveolar nerves, middle superior and anterior superior alveolar nerves

7. Mandibular nerve:

passes through oval foramen and gives off meningeal branch in the infratemporal fossa

Nerve divides → auricular temporal, lingual, inferior alveolar, buccal nerve, motor pure branches

Pure motor branches → masseteric nerve for masseter muscle, deep temporal nerves for temporal muscle, pterygoid nerves for pterygoid muscle, nerve of tensor tympani muscle, nerve of tensor veli palatine muscle.

Auriculotemporal nerve → temporal skin, external acoustic.

Lingual → descends to base of tongue and supplies sensory fibers to anterior 2/3 of tongue..

Inferior alveolar nerve → motor fibers for mylohyoid muscle, digastric muscle.

Sensory fibers → inferior dental branches, mental nerve

Buccal nerve → mucosa of cheek

8. Facial nerve:

7th cranial nerve → motor fibers to muscles of facial expression

Nerve bundle intermediate nerve → taste fibers, parasympathetic fibers

Motor fibers originate in nucleus of facial nerve

They arch around abducens nucleus and emerge on lateral aspect of medulla

Cells of preganglionic secretory fibers from superior salivatory nucleus.

Taste fibers originate in geniculate ganglion and terminate in solitary nucleus

Both parts of nerve pass through inner auditory canal the internal acoustic, enter facial as nerve trunk, canal continues above tympanic cavity, leaves skull through stylomastoid foramen,

Facial canal branches off → greater petrosal nerve, chorda tympani, stapedius nerve

Stapedius nerve supplies stapedius muscle in the middle ear

Chorda tympani branches off above stylomastoid foramen,

Greater petrosal nerve originates from geniculate ganglion, extends through the hiatus for lesser petrosal nerve

Before entering parotid gland, facial nerve gives off posterior auricular nerve . branches to digastrics and stylohyoid muscle

Parotid plexus: temporal , zygomatic, buccal , marginal and mandibular, cervical branch

9. Vestibular nerve-cochlear nerve

8th cranial nerve

Afferent nerve with 2 components → cochlear root, vestibular root.

Vestibular root: nerve fibers originate from vestibular ganglion that lies in internal acoustic meatus.. peripheral processes of cells terminate at epithelia of semicircular ducts

Central processes unite to form vestibular root and terminate in vestibular nuclei of medulla

Vestibular nuclei lie in floor of rhomboid fossa.

Vestibular apparatus balance upright posture, movements of head and vision fixation

Cochlear root: fibers originate from spiral ganglion, a band of cells following spiral course of cochlea, peripheral processes terminate at hair cells of cortis organ. Central processes from small bundles that organize into foraminous spiral tract and combine in internal acoustic meatus to form cochlear root.

Cochlear and vestibular roots extend through internal acoustic meatus into cranial cavity.

Cochlear fibers terminate anterior and posterior cochlear nucleus.

10. Hypoglossal nerve:

12th cranial nerve → exclusively somatomotor nerve for the tongue muscles

Nucleus of hypoglossal forms multipolar neurons in rhomboid fossa → trigon of hypoglossal nerve.

Nerve → leaves skull through canal of hypoglossal nerve, descends laterally to vagus nerve and internal carotid artery, forms arch of hypoglossal nerve, reaches root of tongue above hyoid bone between hypoglossal and mylohyoid muscles..

Fiber bundles of 1st and 2nd cervical nerves adhere to hypoglossal.

Hypoglossal gives off lingual branches to hypoglossal, genitoglossal muscles, styloglossa , intrinsic muscles of body of tongue

11. Accessory nerve

11th cranial nerve → exclusively a motor nerve

Its nucleus the spinal nucleus of accessory nerve forms a narrow cell column from c1 to c6

The neurons lie at lateral aspect of anterior horn

Cells of caudal section supply trapezius muscle, cranial section

Fibers emerge from lateral aspect of cervical spinal cord between posterior and anterior root and combine to form bundle that enters skull as spinal root through foramen magnum

Fibers from caudal part of ambiguous nucleus join as cranial roots

Both components pass through the jugular foramen

After passing fibers change from ambiguous nucleus as internal branches over to vagus nerve

Fibers from cervical spinal cord from the external branch which supplies as accessory nerve

12. Glossopharyngeal nerve

9th cranial nerve → sensory fibers for middle ear tongue and pharynx , motor for muscles of pharynx

Contain viscerosensory, visceromotor , motor and taste fibers

Emerges from medulla behind olives, leaves skull through jugular foramen

In foramen it forms superior ganglion and after passing through it, the inferior ganglion forms arch to root of tongue.

Motor fibers originate from cranial part of ambiguous nucleus . viscera efferent from inferior salivatory nucleus.

The first branch, the tympanic nerve , originates from inferior ganglion, runs through tympanic canaliculus, into tympanic cavity, where it receives fibers from plexus of internal carotid artery via caroticotympanic nerve...forms the tympanic plexus, supplies sensory fibers to mucosa of tympanic cavity and auditory tube..

Inferior ganglion gives connections with vagus, facial, sympathetic NS, ,.. branch of carotid sinus

Glossopharyngeal gives off: pharyngeal branches → stylopharyngeal for stylopharyngeal muscle , tonsillar to tonsils and soft palate..lingual branches(supply tongue with sensory and taste fibers)

13. Spinal nerves:

Peripheral nerves → cranial nerves: enter cranial cavity through foramina, spinal nerves: exit vertebral column

Spinal nerves arise from spinal cord as rootlets which converge to form two nerve roots.

Anterior roots consist of motor and efferent fibers passing from nerve cells in anterior horn of spinal and gray matter to effector organs located peripherally

Posterior root: consists of sensory afferent fibers, from cell bodies in spinal sensory or posterior root ganglion that extend to sensory ending peripherally and centrally to spinal posterior horn

Posterior and anterior roots unite within or just proximal to intervertebral foramen to form a mixed spinal nerve, which divides into two rami: posterior and anterior ramus

Rami contain motor fibers and sensory / cutaneous

Posterior rami remain separate from each other supplying synovial joints of vertebral column, deep muscles of the back, overlying skin

Anterior rami supply remaining area, majority of anterior rami merge with adjacent + anterior rami forming nerve plexuses.

Spinal nerve formed by roots divides into 4 branches: meningeal branch, posterior branch, anterior branch, communicating branch

Spinal nerves pairs: 8 cervical pairs c1-c8, 12 toracic t1-t12,... 5 lumbar l1-l5...5 sacral s1-s5... coccygeal nerves

14. Cutaneous innervations of head and neck

Innervations of the face(sensory)

Face divided from structures originating from pharyngeal arch → cutaneous innervations by branches of trigeminal.. each division passes out of cranial cavity to innervate part of face.. all face covered except from parts of ear

Ophthalmic → supraorbital and supratrochlear, infratrochlear, lacrimal, external nasal

Maxillary→. Small zygomaticotemporal branch, zygomaticofacial branch, infraorbital nerve

Mandibular→ auriculotemporal, buccal, mental

Cutaneous innervations refers to area of skin supplied by specific nerve

Innervation of neck → anterior triangle → transverse cervical nerve, emerges beneath posterior border of sternocleidomastoid

Posterior triangle → cervical plexus → lesser occipital nerve, transverse cervical nerve

Sensory nerves of plexus pass behind the sternocleidomastoid through fascia,

15. Cutaneous innervations of upper limb

Arm and shoulder

Supraclavicular, axillary nerve and lateral cutaneous nerve of arm

Inferior lateral cutaneous nerve of arm → branches from radial

Intercostobrachial

Medial cutaneous nerve of arm/medial brachial cutaneous

Posterior cutaneous nerve of arm/ posterior brachial cutaneous

Forearm → lateral cutaneous nerve of forearm → branch of musculocutaneous

Medial cutaneous nerve of forearm → branch of medial

Posterior cutaneous nerve of forearm → branch of radial nerve

Hand → superficial branch of radial nerve
Median nerve.. superficial branch of ulnar nerve

16. Cutaneous innervations of lower limb

Pelvis and buttocks

Lateral cutaneous nerve of thigh/ lateral femoral cutaneous

Lumboinguinal and ilioinguinal

Medial cluneal nerves, inferior cluneal, superior cluneal, subcostal, iliohypogastric

Thigh → anterior cutaneous branches of femoral nerve, cutaneous branch of obturator nerve, posterior cutaneous nerve of thigh

Leg → common fibular nerve, saphenous, superficial fibular, sural nerve

Foot → deep fibular nerve, tibial nerve, medial plantar nerve, lateral plantar

17. Cutaneous innervations of trunk

Each of the 12 thoracic spinal nerves divides into posterior and anterior branch

Each posterior branch → medial, lateral branch

Sensory innervations of the back comes mainly from lateral branches of posterior branches

The area supplied by posterior branches of cervical nerves,

Anterior branches run as intercostals nerves between the ribs. division → lower/ upper group

Lower group supplies muscles of abdominal wall

Upper group → gives off sensory branches to skin of thorax

18. Cervical plexus

Formed by anterior rami of cervical nerves C2 – C4 and a contribution from anterior ramus of C1. Plexus forms in the substance of muscles making up the floor of posterior triangle within prevertebral layer of cervical fascia and consists of muscular/ deep branches and cutaneous/ superficial branches.

Muscular branches: distribute to several groups of muscles. A major branch is the phrenic nerve which supplies diaphragm with both sensory motor innervation. It arises from the anterior rami of C3 to C5. Hooking around upper lateral border of anterior scalene muscle the nerve continues inferiorly across anterior surface of scalene within prevertebral fascia to enter the thorax. As the nerve descends in the neck it is pinned to scalene by transverse cervical and suprascapular arteries. Several muscular branches of plexus supply prevertebral and lateral vertebral muscle like – rectus capitis lateralis, rectus capitis anterior, longus colli, longus capitis. Plexus contributes to formation of superior and inferior roots of ansa cervicalis. This loop of nerves receives contributions from anterior rami of C1 – C3 and innervates infrahyoid muscles.

Cutaneous branches: visible in posterior triangle as they pass outward from posterior border of sternocleidomastoid muscle.

LESSER OCCIPITAL: consists of contributions of C2 ascends along posterior border of sternocleidomastoid distributes to skin of neck and scalp posterior to ear.

GREAT AURICULAR: consists of branches from C2 – C3 emerges from posterior border of sternocleidomastoid ascends to the base of ear supplies skin of parotid region, ear and mastoid area.

TRANSVERSE CERVICAL: consists of branches from C2 – C3 continues horizontally across sternocleidomastoid supplies lateral and anterior parts of neck.

SUPRACLAVICULAR NERVES: group of nerve from C3 – C4 emerge from posterior border of sternocleidomastoid descend and supply skin over shoulder and clavicle.

19. Brachial plexus

Plexus formed by anterior rami C5 – C8 and T1. Originates in neck, passes laterally and inferior over rib I and enters the axilla. Its parts from Laterally are: ROOTS – TRUNKS – DIVISIONS – CORDS. All major nerves innervating upper originate from plexus, mainly cord.

ROOTS: the anterior rami of C5 – C8 and T1. Close to origin they receive gray rami communicates from sympathetic trunk. These carry postganglionic sympathetic fibers onto roots for distribution to peripheral. Roots and trunks enter posterior triangle of neck by passing between anterior middle scalene muscles.

TRUNKS: originate from roots, pass laterally to rib I and enter axilla. Superior trunk – union of C5 – C6. Middle – C7 continuation. Inferior – union of C8 and T1 → lies posterior to subclavian artery.

DIVISIONS: each trunk divides into anterior and posterior division → 3 anterior form parts that give rise to peripheral nerves associated with parts compartments of arm and forearm. → 3 posterior divisions form parts that give rise to nerves associated with posterior compartments.

CORDS: originate from divisions, related to second part of axillary artery. Lateral cord (union of anterior divisions of superior middle trunks C5-C6), medial cord (continuation of anterior division of inferior trunk C8-T1), posterior cord (3 posterior divisions C5-T1).

Branches of the roots: [a] dorsal scapular (C5 root, motor) [b] long thoracic nerve (C5-C7, motor)

Branches of trunks: [a] suprascapular (superior trunk C5-C6, motor) [b] Nerve to subclavious (superior trunk C5-C6, motor)

Branches of lateral cord: [a] lateral pectoral (lateral cord, C5-C7, motor) [b] musculocutaneous (lateral cord, motor, sensory) [c] lateral root of median nerve

Branches of medial cord: [a] medial pectoral (lateral cord C8-T1, motor) [b] medial cutaneous nerve of arm (medial cord C8-T1, sensory) [c] medial cutaneous nerve of forearm (medial cord C8-T1, sensory) [d] ulnar nerve (medial cord C7-T1, motor, sensory) [e] median nerve (medial and lateral cords C5-T1, motor, sensory)

Branches of posterior cord: [a] superior subscapular (C5-C6, motor) [b] thoracodorsal (C6-C8, motor) [c] inferior subscapular (C5-C6, motor, sensory) [d] axillary (C5-C6, motor, sensory) [e] radial (C5-T1, motor, sensory).

20. Lumbar plexus

Formed by anterior rami of nerves L1-L3 and L4. Also receives contribution from T12. It forms in the substance of psoas major muscle anterior to its attachment to transverse processes of lumbar vertebrae. Branches: anterior – genitofemoral, medial – obturator, lateral – iliohypogastric, femoral, lateral cutaneous of thigh, ilio – inguinal.

ILIOHYPOGASTRIC → L1, motor, sensory) Lateral cutaneous branch – gluteal. Anterior cutaneous branch – pubic region.

ILIOINGUINAL → L1, motor, sensory

GENITOFEMORAL → L1, L2 Genital branch – motor, sensory. Femoral branch – sensory.

LATERAL CUTANEOUS NERVE OF THIGH → L2, L3, sensory

OBTURATOR → L2 – L4, motor, sensory. Anterior branch, posterior branch.

FEMORAL → L2-L4 Motor – medial and intermediate cutaneous nerves. Sensory – saphenous nerve.

21. Sacral plexus

Formed by anterior of S1 – S4 and the lumbosacral trunk (L4 – L5). Formed in relation to anterior surface of piriformis muscle. Sacral contributions pass out of anterior sacral foramina and course laterally and inferiorly on pelvic wall. Lumbosacral trunk courses vertically into pelvic cavity.

Branches:

[a] sciatic tibial → L4-S3, motor, sensory

[b] common fibular → L4 – S2, motor, sensory

[c] Pudental → S2 – S4, motor, sensory

[d] superior gluteal → L4 – S1, motor

[e] Inferior gluteal → L5 – S2, motor

[f] nerve to obturator internus and superior gemellus → L5 – S2, motor

[g] Nerve to quadratus femoris and inferior gemellus → L4 – S1, motor

[h] posterior femoral cutaneous → S1 – S3, sensory

[i] Perforating cutaneous → S1 – S3, sensory

[j] nerve to piriformis → S1 – S2, motor

[k] nerves to levator ani, coccygeus, external anal sphincter → (S4), motor, sensory

[l] pelvic splanchnic nerves → S2 – S4. Motor – stimulate erection, modulate mobility in GIT distal to left colic flexus inhibitory to internal urethral sphincter. Sensory – visceral efferents from pelvic viscera and distal colon. Pain from cervix, bladder and proximal urethra.

22. General anatomy of ANS (autonomic nervous system)

Vegetative or ANS supplies internal organs and their coverings. Almost all tissue are permeated by plexus of delicate nerve fibers. We distinguish between afferent (viscerosensory) fibers and efferent (visceromotor + secretory). Neurons with sensory fibers lie in the spinal ganglia. Neurons, giving rise to efferent, from cell clusters that are surrounded by connective tissue – autonomic ganglia.

Main function of ANS stabilize internal environment and regulate function of organs in accordance with changing requirements. Sympathetic and parasympathetic nervous system.

Sympathetic: stimulated by increased activity physical. Responsible for increased performance under stress.

Parasympathetic: increases peristaltic activity and secretions. Stimulates defecation, urination, pupils constrict. Promotes metabolism, regeneration and body build up reserves.

Division of ANS to sympathetic and parasympathetic refers to visceromotor and secretory fibers.

Distinguished between peripheral and central ANS.

Central autonomic system:

parasympathetic neurons form nuclei in brainstem (salivatory nuclei, dorsal nucleus of vagus nerve).

sacral spinal cord contains parasympathetic neurons. Lateral horn in thoracic and lumbar spinal cord is occupied by sympathetic neurons. Localization of para nuclei – craniosacral and sympathetic nuclei – thoracolumbar.

Cell groups in reticular organ of ANS is hypothalamus coordinates both ANS and endocrine system.

Peripheral autonomic nervous system.

23. Autonomic part of peripheral nervous system – sympathetic part.

Sympathetic nervous system → sympathetic neurons in thoracic and lumbar cord send axons via communicating branches to sympathetic trunk. Trunk consist of a chain of sympathetic ganglia which lie on each side of vertebral column and are connected by interganglionic branches.

3 ganglia in cervical segment → superior and middle cervical ganglion, stellate ganglion.

Thoracic segment contains 10 – 11. Lumbar and sacral 4 ganglia each.

Upper group of ganglia → celiac ganglia → greater splanchnic nerve.

Below → superior and inferior mesenteric ganglia.

Expand in pelvis → superior and inferior hypogastric plexus. Transmission of impulses is mediated by norepinephrine so it is adrenergic system.

Neuron circuit: neurons in intermediomedial and intermediolateral nucleus of thoracic spinal cord send their axons through anterior root into spinal nerve.

According to localization we distinguish 3 ganglia where preganglionic fibers synapse with postganglionic neurons: [a] sympathetic trunk ganglia [b] prevertebral ganglia [c] terminal ganglia → mostly parasympathetic.

Parasympathetic → pre + postganglionic fibers cholinergic. Sympathetic → cholinergic preganglionic fibers synapse in ganglia, with noradrenergic neurons.

Sympathetic innervations of thoracic and cervical viscera → preganglionic sympathetic fibers may synapse with postganglionic neurons in ganglia, may ascend in trunk before and after synapsing, nerves join parasympathetic system sometimes to form plexuses (pulmonary, cardiac) that innervate organ.

Sympathetic innervations of abdomen and pelvic regions and the adrenals → preganglionic fibers may pass sympathetic trunk and paravertebral ganglia without synapsing and together with similar fibers from other levels form splanchnic nerves which pass into abdomen and pelvic regions (sacral plexus).

24. Autonomic part of peripheral nervous system – parasympathetic part

Fibers of central parasympathetic neurons run within cranial nerves to parasympathetic ganglia in head where they synapse. The postganglionic fibers extend to effector organs.

Vagus, principal nerve of parasympathetic nervous system descends together with large cerebral vessels passing through superior thoracic aperture divides into plexuses in thoracic and abdominal viscera.

Cells in intermediolateral and intermediomedial nuclei of sacral axons through 3rd and 4th sacral cord send axons through 3rd and 4th sacral root to the pudendal nerve. From there fibers pass as pelvic nerves into inferior hypogastric plexus and pelvic organs synapses with postganglionic neurons formed in hypogastric plexus or in ganglia of organ plexuses.

As in sympathetic nervous system peripheral supply provided by 2 neurons → preganglionic in spinal cord, postganglionic in ganglia.

Parasympathetic nervous system is cholinergic → impulse transmission by Ach.

25. Eye ball

Development: light sensitive part of eye is derivative of diencephalon. At end of 1st month of embryonic development the two optic vesicles are formed as evaginations of prosencephalon.

Optic vesicles then induce thickenings in ectoderm. Later evaginate as lens vesicles. Epithelial cells of posterior vesicles elongate into lens fibers which form main part of lens. Anterior vesicle wall persists as lens epithelium. Anterior and posterior walls of optic vesicles approximate to form optic cup. Lumen of vesicle – originally part of ventricular system – the optic ventricles, becomes narrow cavity.

Optic cup → inner layer (neural), outer layer (pigmented layer)

Structure → anterior aspect consists of transparent cornea. Behind lies lens of the eye overlaid by iris, with its central opening the pupil. The optic nerve exits at posterior wall of eyeball.

Three cavities in the eye → anterior chamber covered by cornea, iris, lens → posterior chamber ring around lens → interior of eye which contains.

Wall of eyeball consists of 3 layers → [a] fibrous tunic of eyeball or sclera, thick stretch resistant connective tissue capsule. [b] vascular tunic of eyeball or uvea (forms iris) [c] internal tunic of eyeball or retina.

Posterior/ optic part of eyeball or retina. Anterior/ blind part contains only pigmented epithelium. Border between retinal parts is ora serrata.

Eyeball → anterior and posterior pole → equator of eyeball.

Blood vessels and muscles follow meridians of eyeball which run from pole to pole.

Eyeball → anterior part (contains image forming apparatus), posterior part → contains photoreceptive surface, the retina.

26. Accessory visual structures

The accessory organs of the eye include the orbital muscles, orbital fasciae, eyelids (palpebrae), conjunctiva and the lacrimal apparatus.

Orbital muscles: Levator palpebrae superioris, Four recti (superior, inferior, lateral and medial), Two oblique (*Inferior oblique, Superior oblique*)

Orbital fasciae: The fascial sheath envelops the eyeball from the optic nerve to the sclerocorneal junction, forming the actual socket for the eyeball. It is separated from the sclera by the episcleral space, which contains loose fibrous tissue giving blood supply for the sclera.

Eyelids – palpebrae: The eyelids are two thin moveable folds placed in front of the eye. When closed, they cover the eyeball anteriorly, thereby protecting it from injury and excessive light. They also keep the cornea moist by spreading the lacrimal fluid. The eyelids are covered externally by thin skin, and internally by palpebral conjunctiva.

The eyelid consists of: Skin – extremely thin, subcutaneous areolar tissue devoid of fat, Palpebral fibers of orbicularis oculi muscle, *Tarsus*.

Conjunctiva: is a transparent mucous membrane which lines the inner surface of the eyelids and is reflected over the frontal part of the sclera, forming superior and inferior fornix of conjunctiva.

Vessels and nerves of palpebrae and conjunctiva: Branches of ophthalmic, infraorbital and temporal superficial arteries and branches of ophthalmic and infraorbital nerves

Lacrimal apparatus → Lacrimal glands: is divided into superior (orbital) and inferior (palpebral) parts. →

Lacrimal sac: is the upper blind end of the nasolacrimal duct. It is lodged in the fossa of the lacrimal sac in the lacrimal bone. → Nasolacrimal duct: This is a membranous canal about 20 mm long, extending from lower end of lacrimal sac to inferior nasal meatus.

27. Gustatory pathway

Taste buds/ gustatory receptors

Register different taste sensations

Taste buds and olfactory epithelium → chemoreceptors

Found in largenumber in lateral walls of vallate papillaez,

Found in moderate numbers in fungi form and foliate papillae

Found isolated in soft palate, pharyngeal wall, epiglottis
 Consist of modified epithelial cells
 Small opening at epithelial surface, the taste pore into which sensory cells send processes
 Sensory cells generated from epithelial cells at base of bud.
 Base innervated by thin myelinated nerve fibers that branch and supply adjacent epithelium
 Taste buds contain 3 cell types: clear taste cells, small basal cells, dark supporting cells
 Taste sensation: sour, salty, bitter, sweet
 Taste fibers: assigned to three cranial nerves (facial, glossopharyngeal, vagus)
 Originate from pseudounipolar neurons in cranial nerve ganglia (geniculate ganglion, petrosal ganglion, nodose ganglion)
 Primary taste fibers terminate in solitary nuclear complex
 Secondary taste fibers originate from solitary nuclear complex

28. Vestibulocochlear organ

Inner ear → osseous labyrinth (perilymph) → membranous labyrinth (endolymph)
 Vestibular window is closed by stapes and leads into the middle part of osseous labyrinth, the vestibule of ear.
 Vestibule communicates anteriorly with bony cochlea and posteriorly with semicircular canals.
 Vestibule contains two membranous parts → saccule and utricle.
 Both contain sensory epithelium → macula of saccule, and macula of utricle.
 Duct gives off endolymphatic duct which runs to endolymphatic sac. Uniting duct forms connection between saccule and membranous cochlear duct.
 Osseous cochlea has two and a half turns.
 Spiral canal of cochlea contains cochlear duct which starts with vestibular cecum and ends in cupula.
 Scala vestibuli lies above it and opens into vestibule.
 Scala tympani lies beneath it and is closed to cochlear window.

29. External ear and tympanic cavity

External ear: auricle or pinna contains scaffold of elastic cartilage. Shapes of auricular projections and depressions differ in each person. Shapes inherited: helix, antihelix, scapha, concha, triangular fossa, tragus, antitragus.
 Entrance of outer ear canal – external acoustic meatus is formed by continuation of auricular cartilage and is completed with tissue to form uniform passage. Passage is lined with epidermis and large ceruminous glands lies beneath epidermis.
 Outer ear canal ends with eardrum or tympanic membrane which is obliquely placed in meatus.
 Above upper end of malleolar stria lies reddish pars flaccida which is separated from gray pars tensa by two malleolar folds. The fibrocartilaginous annulus forms anchoring tissue of eardrum.
 Middle ear → tympanic cavity → lateral wall (eardrum) → medial (2 openings leading to internal ear, oval/ vestibular, round/ cochlear window)
 Continues in anterior direction as auditory tube. Posterior part – into mastoid antrum with numerous small cavities open.
 Medial wall of tympanic cavity → middle ear cavity from internal ear. Prominence in middle region – the promontory of tympanic cavity. Two windows open into internal ear. In posterior wall opening to mastoid antrum run two arched canals (facial, lateral semicircular). In anterior direction cavity lead into semicanal of auditory tube. Above lies semicanal of tensor tympani muscle. Two semicanals form the musculotubal canal.
 Carotid wall – separates cavity from carotid canal. Jugular wall separates cavity from jugular fossa.

30. The integument

Integumentary system is the largest organ system comprising the skin and its appendages (hair, nails..).
 Epidermis top layer of skin made up of epithelial cells. Consists of keratinized stratified squamous epithelium comprising keratinocytes, melanocytes, merkel cells, langerhans cells.
 Epidermis contains squamous cells, basal cells, melanocytes. 5 layers (lower to upper) stratum basale → stratum spinosum → stratum granulosum → stratum lucidum → stratum corneum.
 Dermis – middle layer of skin. Composed of loose connective tissues such as collagen with elastin arranged in a bundled pattern. These layers give elasticity allowing stretching and flexibility.

Subdermis → not part of skin but of integument. Composed of connective adipose tissue.

Functions → protect tissues and organs, protection from infections organisms, protection from dehydration, protection from T change, protection against sunburn, store fat, glucose H₂O, VitD, T regulation, generate VitD, receptor for touch, P, pain, heat, cold.

31. Mammary gland

Are the organs that produce milk for the sustenance of youth. These exocrine glands are enlarged modified sweat glands and give mammals their name.

Structure: basic components are some hollow cavities, the alveoli lined with milk – secreting cuboidal cells and surrounded by myoepithelial cells. Alveoli join to form groups, known as lobules and lobule has a lactiferous duct that drains into openings in nipple.

Myoepithelial cells can contract under stimulation of oxytocin thereby excreting milk secreted milk secreted from alveolar units into lobule lumen toward the nipple.

Development → exist in both sexes during embryonic stage. Forming a rudimentary duct tree at birth. Secondary duct development occurs in females in response to circulating ovarian hormones from puberty. Estrogen promotes branching differentiation testosterone inhibits it.